POLARAD

HANDBOOK OF OPERATING AND MAINTENANCE INSTRUCTIONS

MICROWAVE RECEIVER MODEL TR

POLARAD ELECTRONIC INSTRUMENTS
DIVISION OF POLARAD ELECTRONICS CORPORATION
34-02 QUEENS BLVD., LONG ISLAND CITY 1, N. Y.

POLARAD

INSTRUCTION MANUAL

MICROWAVE RECEIVER
MODEL TR

POLARAD ELECTRONIC INSTRUMENTS

A DIVISION OF POLARAD ELECTRONICS CORPORATION

34-02 QUEENS BOULEVARD · LONG ISLAND CITY 1, N.Y. · AREA CODE 212 · EXETER 2-4500

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WARRANTY

Polarad Electronic Instruments, a division of Polarad Electronics Corporation, warrants each instrument of its manufacture to be free from defects in material and workmanship. Our obligation under this warranty is limited to servicing or adjusting any instrument returned to our factory for that purpose and to making good at our factory any part or parts thereof (except tubes, transistors, batteries, diodes, and crystals) which shall, within one year after making delivery to the original purchaser, be returned to us with transportation charges prepaid, and which in our examination shall disclose to our satisfaction to have been thus defective. Warranty returns must first be authorized by Polarad.

Polarad Electronic Instruments reserves the right to make changes in the design of its instruments without incurring any obligation to make the same changes on equipments previously purchased.

This warranty is expressly in lieu of all other obligations or liabilities on the part of Polarad Electronics Corporation and Polarad neither assumes nor authorizes any person to assume for them any other liability in connection with the sale of Polarad's instruments.

SPECIFICATION CHANGE NOTICE

MODEL TR

In paragraph 1-21

a. Change the recorder output specification to read:

"Scale Selector switch set to 70 DB or uV	1 volt swing (minimum) into 100K
Scale Selector switch set to LIN	8 volt swing (minimum) into 100K"

b. Change the operating power requirements specification to read:

Ac	115 or 230 volts (±10%), single-phase, 50 to 1,000 cps, 310 watts
Dc	12 volts (±10%), 17 amps

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ERRATA

Incorporate the following changes into step 6 of table 4-4:

a. Change the "Procedure" column to read

"Set the tuning unit under test to the low end of the band. Set the Scale Selector switch to 70 DB and, with no signal applied, adjust the IF GAIN control to obtain an Output meter indication of CAL. Adjust a microwave signal generator for a cw output of approximately -10 dbm and connect the equipment as illustrated in figure 4-1b. Sweep the generator throughout the band of the tuning unit. Determine the sensitivity (without adjusting the Tuning control) at frequencies which produce meter deflections. The rejection (in db) of the tuning unit is equal to the difference between the sensitivity measured above and the sensitivity at the tuning unit dial frequency (the latter determined per step 4).

Repeat the above in 200 mc increments throughout the remainder of the band of the tuning unit under test."

b. Change the "Normal Indication" column to read

"All image and spurious responses shall be rejected by at least 60 db."

TR

DIFFERENCE DATA SHEET

MODEL TR

MICROWAVE RECEIVER

Incorporate the changes listed below into the existing handbook to reflect equipment serial numbers 3-1 and up.

In table 1-3:

a. Change "CR809 and CR811 through CR813; CR818, CR819, and CR821 through CR824," "CER-71," "Voltage doublers" to read "CR809 and CR811; CR818 and CR819," "HV-20C-2," "Voltage doublers."
b. Change diode type of CR1202 from TD02 to HV-20C-2.
c. Change diode type of CR1302 from TD02 to HV-20C-2.
d. Change diode type of CR1402 from TD02 to HV-20C-2.
e. Change diode type of CR1502 from TD02 to HV-20C-2.

In figure 3-5, change the value of R5 from 22K to 10K.

In paragraph 3-72, change the second sentence to read: ".....the voltage doubler consisting of diodes CR818 and CR819."

In paragraph 3-75, change the second sentence to read: ".....the voltage doubler consisting of diodes CR809 and CR811."

In figure 3-6:

a. Change the block "VOLTAGE DOUBLER CR818, CR819 & CR821 THRU CR824" to read "VOLTAGE DOUBLER CR818 & CR819."
b. Change the block "VOLTAGE DOUBLER CR809, CR811, CR812 & CR813" to read "VOLTAGE DOUBLER CR809 & CR811."

In figure 5-1:

a. Delete terminal 1 of TB1203.
b. Reduce each TB1203 terminal reference number by one integer (i.e., TB1203-8 becomes TB1203-7).
c. Change diode type of CR1202 from TD02 to HV-20C-2.

In figure 5-2:

a. Delete terminal 1 of TB1303.
b. Reduce each TB1303 terminal reference number by one integer (i.e., TB1303-7 becomes TB1303-6).
c. Change diode type of CR1302 from TD02 to HV-20C-2.

In figure 5-3:

a. Delete terminal 1 of TB1403.
b. Reduce each TB1403 terminal reference number by one integer (i.e., TB1403-4 becomes TB1403-3).
c. Change diode type of CR1402 from TD02 to HV-20C-2.

In figure 5-4:

a. Delete terminal 1 of TB1503.
b. Reduce each TB1503 terminal reference number by one integer (i.e., TB1503-9 becomes TB1503-8).
c. Change diode type of CR1502-2.

In figure 5-6, add lead from P204-D to junction of C231 and P204-H. Label P204-D to read "XTAL MA."

In figure 5-14, change the value of R5 from 22K to 10K.

In figure 5-15:

a. Incorporate the changes illustrated in figure A.
b. Add *C820, 16UF, 150V between P801-E and ground.

In figure 5-16:

a. Add lead from J1106-39 to harness. Label lead "101 XTAL MA."
b. Add lead from J204-D to harness. Label lead "101 XTAL MA."

* Employed only in equipment serial nos. 4-1 and up.

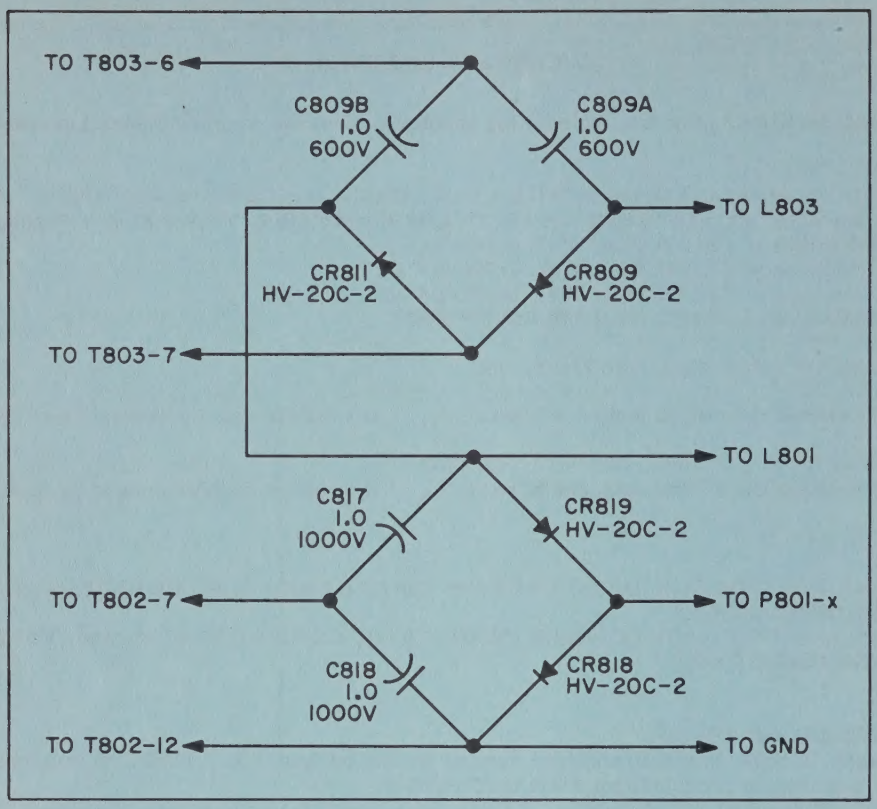

Figure A. Changes to Be Incorporated Into Figure 5-16

In table 5-9:

a. Delete the rows containing CR812, CR813, CR821, CR822, CR823 and CR824.
b. Change CR809, CR811, CR818 and CR819 diode types from TD02 to HV-20C-2.
c. Change anode voltage of CR809 from "-500(a)" to "-600(a)."
d. Change cathode voltage of CR809 from "-300(a)" to "-500(a)."
e. Change anode voltage of CR811 from "-600(a)" to "-500(a)."
f. Change cathode voltage of CR811 from "-500(a)" to "0(a)."
g. Change anode voltage of CR818 from "-170(b), -750(c)" to "-160(b), -600(c)."
h. Change cathode voltage of CR818 from "-160(b), -600(c)" to "0(b), 0(c)."
i. Change anode voltage of CR819 from "-327(b), -1150(c)" to "-330(b), -1250(c)."
j. Change cathode voltage of CR819 from "-170(b), -750(c)" to "-160(b), -600(c)."

In table 6-2, incorporate the changes listed in table I.

In table 6-3, incorporate the changes listed in table II.

In table 6-4, incorporate the changes listed in table III.

In table 6-5, incorporate the changes listed in table IV.

In table 6-6, incorporate the changes listed in table V.

TABLE I. CHANGES TO BE INCORPORATED INTO TABLE 6-2

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
CR809	SEMICONDUCTOR DEVICE, DIODE /POLARAD PART NUMBER A710666	HV-20C-2	GJ	20
CR811	SAME AS CR809			
CR812 AND CR813	NOT USED			
CR821 THRU CR824	NOT USED			
C6	CAPACITOR, FILM, 0.1UF, 10 PCT, 125WVDC /POLARAD PART NUMBER B709995	C926AA/A100K	BN	1
C102 AND C103	CAPACITOR, CERAMIC, 1000UUF, 20PCT, 500WVDC /POLARAD PART NUMBER B706421	SB4A-102W	D	4
C224	CAPACITOR, CERAMIC, 1000UUF, 500WVDC /POLARAD PART NUMBER B706451	FB2B-102W	D	4
C503 AND C504	SAME AS C102			
C506	SAME AS C102			
C508 AND C509	SAME AS C102			
C512 AND C513	SAME AS C102			
C517 AND C518	SAME AS C102			
C526	SAME AS C102			
C820*	CAPACITOR, ELECTROLYTIC, 16UF, 150WVDC /POLARAD PART NO. B708471	BBR16-150	U	1
C4215	SAME AS C102			
C4506	SAME AS C102			
J4	CONNECTOR, RECEPTACLE, FEMALE, TELEPHONE TYPE	JJ-089	AU	1
J5	CONNECTOR, RECEPTACLE, FEMALE, TELEPHONE TYPE	JJ-083	AU	1
R5 AND R6	RESISTOR, FIXED, COMPOSITION, 10K, 10 PCT, 1/2W	RC20GF103K	AU	1
R803 THRU R806	NOT USED			
R818 THRU R821	NOT USED			
R829 AND R830	NOT USED			

*Employed only in equipment serial nos. 4-1 and up.

TABLE II. CHANGES TO BE INCORPORATED INTO TABLE 6-3

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
CR1202	SEMICONDUCTOR DEVICE, DIODE /POLARAD PART NUMBER A710666	HV-20C-2	GJ	5
TB1203	TERMINAL BOARD /POLARAD PART NUMBER B704564	600-9	FD	1

TABLE III. CHANGES TO BE INCORPORATED INTO TABLE 6-4

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
CR1302	SEMICONDUCTOR DEVICE, DIODE /POLARAD PART NUMBER A710666	HV-20C-2	GJ	5
TB1303	TERMINAL BOARD /POLARAD PART NUMBER B704564	600-9	FD	1

TABLE V. CHANGES TO BE INCORPORATED INTO TABLE 6-6

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
A1501	OSCILLATOR ASSY	C147657	BE	1
CR1502	SEMICONDUCTOR DEVICE, DIODE /POLARAD PART NUMBER A710666	HV-20C-2	GJ	5
TB1503	TERMINAL BOARD /POLARAD PART NUMBER B704564	600-9	FD	1

TABLE IV. CHANGES TO BE INCORPORATED INTO TABLE 6-5

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
A1401	OSCILLATOR ASSY	C147644	BE	1
CR1402	SEMICONDUCTOR DEVICE, DIODE /POLARAD PART NUMBER A710666	HV-20C-2	GJ	5
TB1403	TERMINAL BOARD /POLARAD PART NUMBER B704564	600-9	FD	1
W73	CABLE AND PROBE ASSY	C148899	BE	1

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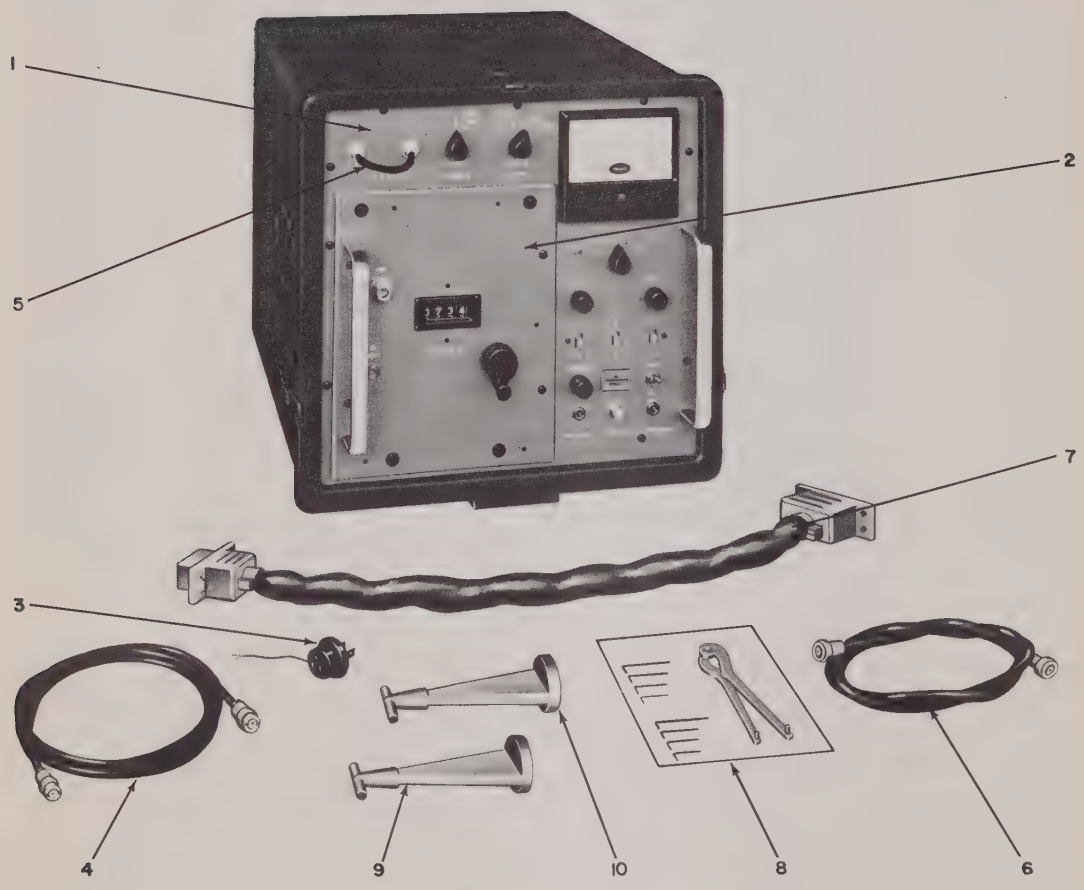


1. Model T-B Basic Unit
2. Model T-RX Tuning Unit
3. Power Cable Adapter CP1100
4. R-f Cable Assembly W31
5. I-f Cable Assembly W13
6. Video Cable Assembly W32
7. Patch Cable Assembly W35
8. Wrench Kit A1101
9. Klystron Wrench MP1101
10. Klystron Wrench MP1100

Figure 1-1. Model TR Microwave Receiver System

SECTION I

INTRODUCTION

1-1. SCOPE OF MANUAL.

1-2. This manual contains instructions for the use and maintenance of the Model TR Microwave Receiver (see figure 1-1), manufactured by the Polard Electronic Instruments Division of Polarad Electronics Corporation, Long Island City, N. Y. The manual includes a general description of the Model TR Microwave Receiver system, operating instructions, theory of operation, maintenance information, and schematic diagrams.

1-3. PURPOSE AND USE OF EQUIPMENT.

1-4. The Polarad Model TR Microwave Receiver (hereafter referred to as the Model TR) is a sensitive and frequency-selective test instrument which provides broad frequency coverage by means of four interchangeable plug-in tuning units. The Model TR permits comparative voltage (power) measurements of virtually every type of signal found in microwave work. In addition, audio, video, and recorder outputs are provided for external monitoring of these signals.

1-5. Specific applications of the Model TR are its use as a:

a. Broadband receiver for the reception of continuous-wave (cw), frequency-modulated (fm), amplitude-modulated (am), and pulse-modulated rf signals;

b. Means of measuring the relative power level between a fundamental frequency signal and its harmonics;

c. Means of measuring the bandwidth of microwave cavities;

d. Frequency meter;

e. Means of measuring the noise figure of rf amplifiers;

f. Means of measuring and calibrating the rate of attenuation of attenuators over a range of 70 db.

1-6. GENERAL DESCRIPTION.

1-7. The Model TR is a self-contained, compact unit consisting of the Model T-B Basic Unit and four interchangeable, plug-in tuning units. In operation, one of the four interchangeable plug-in tuning units is installed in the basic unit so that the two combine to appear as a single assembly, as illustrated in figure 1-1.

1-8. The Model T-B Basic Unit, which contains the control and monitoring circuitry of the Model TR system, consists of a panel, frame, and chassis assembly. The front panel assembly serves as a mounting for the basic unit operating controls, indicators, and connectors. The lower left-hand area of the basic unit front panel assembly has an opening designed to accept any one of the four interchangeable, plug-in tuning units.

1-9. Each interchangeable, plug-in tuning unit contains the r-f receiving circuitry that is continuously tunable throughout its specified frequency range. The front panel assembly of the tuning unit serves as a mounting for its operating controls, indicators, and connectors.

1-10. MODEL TR SYSTEM COMPONENTS.

1-11. The components which comprise the complete Model TR system (see figure 1-1) are listed in table 1-1 and described in paragraphs 1-12 through 1-20.

1-12. MODEL T-B BASIC UNIT. The basic unit, which is the control and monitoring portion of the Model TR system, is supplied as an integral component.

1-13. INTERCHANGEABLE PLUG-IN TUNING UNITS. The four interchangeable plug-in tuning units available are supplied as ordered. These include the:

a. Model T-RL Tuning unit, which covers the frequency range from 0.95 to 2.04 gc;

b. Model T-RS Tuning Unit, which covers the frequency range from 1.90 to 4.34 gc;

c. Model T-RM Tuning Unit, which covers the frequency range from 4.20 to 7.74 gc;

d. Model T-RX Tuning Unit, which covers the frequency range from 7.30 to 11.26 gc;

1-14. POWER CABLE ADAPTER CP1100. This adapter is supplied to adapt a two-wire power outlet to the polarized three-prong connector terminating the basic unit power cable.

1-15. R-F CABLE ASSEMBLY W31. This six-foot cable assembly, consisting of type RG-9B/U coaxial cable terminated with type UG-21D/U connectors at

TABLE 1-1. MODEL TR SYSTEM COMPONENTS

System Component	Figure 1-1 Index Number	Polarad Model or Part Number
Basic Unit	1	T-B
Tuning Unit	Not Shown	T-RL
Tuning Unit	Not Shown	T-RS
Tuning Unit	Not Shown	T-RM
Tuning Unit	2	T-RX
Power Cable Adapter CP1100	3	A131966
R-f Cable Assembly W31	4	B12551
I-f Cable Assembly W13	5	C143031
Video Cable Assembly W32	6	B12553
Patch Cable Assembly W35	7	C146172
Wrench Kit A1101	8	A25109
Klystron Wrench MP1101	9	B144525
Klystron Wrench MP1100	10	B144477

each end, is employed to couple the r-f signal under measurement to the tuning unit INPUT connector.

1-16. I-F CABLE ASSEMBLY W13. This six-inch cable assembly, consisting of type RG-55/U coaxial cable terminated with type TNC connectors at each end, is employed as a jumper cable to couple the IF output connector to the IF input connector.

1-17. VIDEO CABLE ASSEMBLY W32. This eight-foot cable assembly, which consists of type RG-58/U coaxial cable terminated with type UG-88/U connectors at each end, is employed to couple the VIDEO OUTPUT connector to an external oscilloscope.

1-18. PATCH CABLE ASSEMBLY W35. This 40-inch harnessed cable assembly, which is terminated with multipin connectors at each end, is employed to interconnect the tuning unit and basic unit when the former is removed from the latter during routine maintenance operations.

1-19. WRENCH KIT A1101. This kit contains the hand tools required to adjust and align the various subassemblies of the Model TR system. The contents of the wrench kit are listed in table 1-2.

TABLE 1-2. WRENCH KIT TOOLS

Tool	Polarad Part No.
Spanner Wrench MP1104	A15550
No. 4 Spline Wrench MP1105	A515101
No. 6 Spline Wrench MP1106	A515102
No. 8 Spline Wrench MP1107	A515103
No. 10 Spline Wrench MP1108	A515104
No. 4 Allen Wrench MP1109	A515301
No. 6 Allen Wrench MP1110	A515302
No. 8 Allen Wrench MP1111	A515303
No. 10 Allen Wrench MP1112	A515304

1-20. KLYSTRON WRENCHES MP1100 AND MP1101. These klystron wrenches are employed when replacing the first local oscillator reflex klystron tubes. Klystron Wrench MP1100 is used in conjunction with the Models T-RL and T-RS Tuning Units, while Klystron Wrench MP1101 is used in conjunction with the Models T-RM and T-RX Tuning Units.

1-21. GENERAL ELECTRICAL CHARACTERISTICS.

1-22. The general electrical characteristics of the Model TR are listed below:

Frequency range	0.95 to 11.26 gc in four overlapping bands
Model T-RL Tuning Unit	0.95 to 2.04 gc
Model T-RS Tuning Unit	1.90 to 4.34 gc
Model T-RM Tuning Unit	4.20 to 7.74 gc
Model T-RX Tuning Unit	7.30 to 11.26 gc

Fequency accuracy	±1% of dial indication
Input impedance	50 ohms (nominal)
Receiver type	Triple-conversion superheterodyne

Minimum rf sensitivity (signal plus noise equals twice noise at an impulse bandwidth of 1 mc):

Model T-RL Tuning Unit	-90 dbm
Model T-RS Tuning Unit	-90 dbm
Model T-RM Tuning Unit	-88 dbm
Model T-RX Tuning Unit	-88 dbm

Image and spurious response rejection	60 db
Intermediate frequencies	Three
First	260 mc
Second	140 mc
Third	40 mc
Weighting circuits	Average, Quasi-Peak, Peak, and Slideback Peak

Weighting circuit time constants:

Average and slideback	Charge Time: 0.1 microseconds; Discharge Time: 0.3 microseconds
Quasi-peak	Charge Time: 50 microseconds; Discharge Time: 500 milliseconds
Peak	Charge Time: 0.1 microseconds; Discharge Time: 1 second
Impulse bandwidths	1 mc, 5 mc, and wideband

Recorder output:

Scale Selector switch at 70 DB	3 volt swing into 100KΩ
Scale Selector switch at μV	2.5 volt swing into 100KΩ
Scale Selector switch at LIN	10 volt swing into 100KΩ
Video output	0.2 volts (minimum) into 1KΩ
Video bandwidth	4 mc
Audio output	0.25 watts into 600 ohms

Operating power requirements:

Ac	115 or 230 volts ± 10%, single-phase, 50 to 1,000 cps, 200 watts
Dc	12 volts ± 10%, 13 amperes

1-23. ELECTRON TUBE CRYSTAL DIODE, TRANSISTOR, FUSE, AND INDICATOR LAMP COMPLEMENT.

1-24. Table 1-3 lists the types and functions of the entire complement of electron tubes, crystal diodes, and transistors employed in the Model TR system. The types and functions of the fuses and indicator lamps employed in the system are listed in table 1-4.

TABLE 1-3. ELECTRON TUBE, CRYSTAL DIODE, AND TRANSISTOR COMPLEMENT

Reference Symbol Number	Electron Tube, Crystal Diode, or Transistor Type	Function
Frame (Model T-B Basic Unit)		
CR2	1N1217	Polarity protection diode
Q1 and Q2	2N553	Inverter
140/40-Mc I-f Amplifier (Model T-B Basic Unit)		
CR101	1N198	Compensating diode
Q101 through Q104	2N700	140-mc i-f amplifiers
Q105	PADT 30	Third mixer
Q106	PADT 30	40-mc i-f amplifier
260/140-Mc Low-Noise Preamplifier (Model T-B Basic Unit)		
CR201	1N82	Second mixer
Q201	PADT 30	140-mc i-f amplifier
V201 and V202	7077	260-mc i-f amplifiers
Crystal-Controlled Local Oscillator (Model T-B Basic Unit)		
Q301	2N499	60-mc oscillator
Q302	2N502	Buffer amplifier
Q303	2N499	Frequency doubler
Q304	2N499	Frequency tripler
Q305	2N1143	120-mc power amplifier
Q306	2N700	180-mc power amplifier
40-Mc I-f Amplifier (Model T-B Basic Unit)		
CR402	FD100	First detector
Q401	2N502	40-mc i-f amplifier
Q402 and Q403	2N384	40-mc i-f amplifier
Q404	2N1143	Video amplifier
Q405	2N741	Video amplifier
V401	5639	40-mc i-f amplifier

(Cont'd)

TABLE 1-3. ELECTRON TUBE, CRYSTAL DIODE, AND TRANSISTOR COMPLEMENT (Cont'd)

Reference Symbol Number	Electron Tube, Crystal Diode, or Transistor Type	Function
Fm/Afc Amplifier (Model T-B Basic Unit)		
CR501 and CR502	1N251	Limiter diodes
CR503 and CR504	1N198	Discriminator diodes
Q501	PADT 30	40-mc i-f amplifier
Q502	2N384	40-mc limiter
Q503	PADT 30	40-mc i-f amplifier
Q504	113S2	D-c amplifier
1-Kc Oscillator/Audio Amplifier (Model T-B Basic Unit)		
Q601	2N185	Audio amplifier
Q602	113S2	Audio amplifier
Q603	2N234A	Audio power amplifier
Q604	2N185	1-kc oscillator
Q605	2N427	Audio amplifier
Peak Detector/Metering Amplifier (Model T-B Basic Unit)		
CR701	1N690	Second detector
CR702	1N816	Compensating diode
CR703	1N816	Compensating diode
Q701	113S2	D-c amplifier
Q702	T1494	D-c amplifier
V701	6021	Difference amplifier
Power Supply (Model T-B Basic Unit)		
CR801 through CR804	1N3208	Full-wave bridge rectifier
CR806 and CR817	1N1929	Voltage references
CR807 and CR808; CR814 and CR816	1N2069	Full-wave rectifiers

(Cont'd)

TABLE 1-3. ELECTRON TUBE, CRYSTAL DIODE, AND TRANSISTOR COMPLEMENT (Cont'd)

Reference Symbol Number	Electron Tube, Crystal Diode, or Transistor Type	Function
Power Supply (Cont'd)		
CR809 and CR811 through CR813; CR818, CR819, and CR821 through CR824	1N2071	Voltage doublers
CR810 and CR820	1N816	Compensating diodes
CR815 and CR846	1N2069	Starting diodes
CR827 and CR833	1N2069	Half-wave rectifiers
CR831	1M25Z5	Voltage regulator
CR838 and CR839	1N3001B	Voltage regulators
CR841	1N2976B	Voltage regulator
CR842 and CR843	1N2069	Voltage doubler
CR844	1N2986B	Voltage regulator
CR847	1N3016B	Voltage regulator
CR848	1N538	Half-wave rectifier
CR849	1N625	Compensating diode
CR851	1N3016B	Voltage reference
Q802, Q806, Q807, Q814, Q816, and Q817	2N1136	Pass transistors
Q808, Q809, Q821 and Q822	2N1136	Emitter followers
Q811 and Q823	113S2	Control amplifiers
Q812 and Q813	2N1136	Reflector supply driven inverter
Q818 and Q819	2N1136	Beam supply inverter
Q824	113S2	D-c amplifier

(Cont'd)

TABLE 1-3. ELECTRON TUBE, CRYSTAL DIODE, AND TRANSISTOR COMPLEMENT (Cont'd)

Reference Symbol Number	Electron Tube, Crystal Diode, or Transistor Type	Function
140/40-Mc Band-Pass Filter (Model T-B Basic Unit)		
Q4201	PADT 30	40-mc i-f amplifier
Model T-RL Tuning Unit		
CR1201	1N21D	First crystal mixer
CR1202	XS23A	Protective diode
V1201	ZV1010/7505	Klystron first local oscillator
Model T-RS Tuning Unit		
CR1301	1N21D	First crystal mixer
CR1302	XS23A	Protective diode
V1301	ZV1009/7049	Klystron first local oscillator
Model T-RM Tuning Unit		
CR1401	1N23D	First crystal mixer
CR1402	XS23A	Protective diode
V1401	ZV1011/8052	Klystron first local oscillator
Model T-RX Tuning Unit		
CR1501	1N2510A	First crystal mixer
CR1502	XS23A	Protective diode
V1501	ZV1011/8052	Klystron first local oscillator

TABLE 1-4. FUSE AND INDICATOR LAMP COMPLEMENT

Reference Symbol Number	Type	Function
Fuses		
F1 and F2*	3AG, 4 amperes	Power line protective fuses (a-c)
F3 and F4	3AG, 20 amperes	Power line protective fuses (d-c)
Indicator Lamps		
DS1 through DS4	GE 330	ON OPERATE pilot lamps

* For 230-volt operation, replace with type 3AG fuses rated at 2 amperes @ 250 V.

SECTION II

OPERATION

2-1. GENERAL.

2-2. The Model TR is shipped complete and is ready to use upon delivery; no permanent or special installation procedures are necessary. The Model TR system can be used in either laboratory or field applications. The system components should be unpacked upon receipt, observing the usual precautions for unpacking a delicate instrument.

WARNING

THE MODEL T-B BASIC UNIT (WITH A TUNING UNIT INSTALLED) WEIGHT APPROXIMATELY 95 POUNDS. IT IS STRONGLY RECOMMENDED THAT TWO PERSONS BE EMPLOYED AT ALL TIMES IN UNPACKING, LIFTING, TRANSPORTING, AND REPACKING THE EQUIPMENT.

2-3. INSTALLATION.

2-4. After unpacking the Model TR system components, plan their installation. The Model TR is normally supplied in a cabinet-mounted configuration (see figure 2-1) for bench or cart use. A flush-panel rack-mounted configuration of the Model TR (see figure 2-2) is available on special order.

2-5. OPERATION.

2-6. The operating procedures for proper operation of the Model TR, as well as typical applications, are described in paragraphs 2-7 through 2-15.

2-7. OPERATING CONTROLS, INDICATORS, AND CONNECTORS. The operating controls, indicators, and connectors necessary for the operation of the Model TR are located on the basic unit and tuning unit front panel assemblies, as shown in figure 2-3; their functions are described in table 2-1.

2-8. STARTING PROCEDURE. To apply operating power to the Model TR, proceed as indicated in the following steps:

a. Set the POWER OFF switch to OFF.

b. Disconnect the power cable from the power source outlet.

c. Determine the nature of the power available at the source outlet.

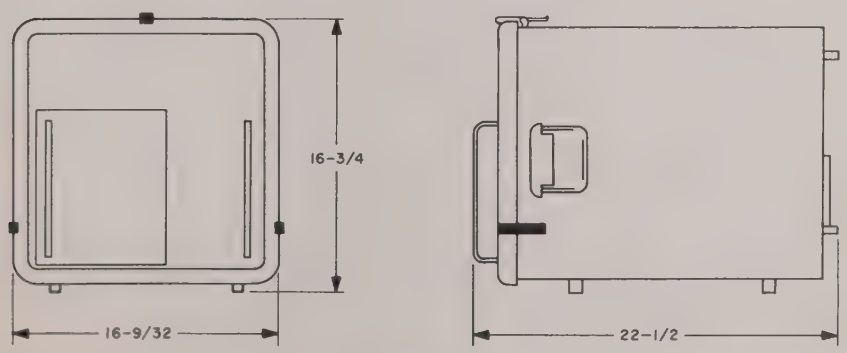


Figure 2-1. Model TR Microwave Receiver, Installation Outline Diagram

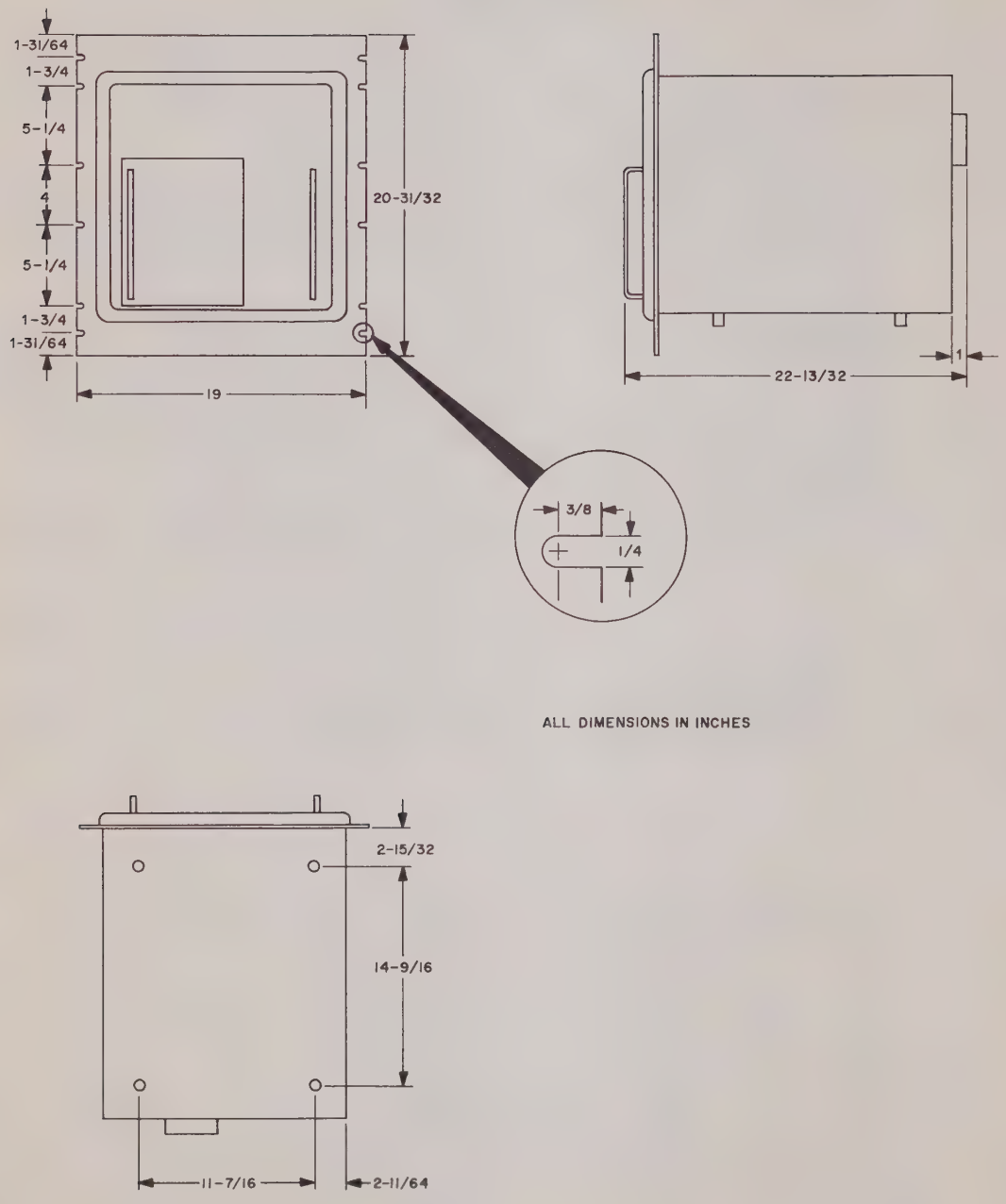


Figure 2-2. Model TR Microwave Receiver (Flush-Panel Rack-Mounted Configuration), Installation Outline Diagram

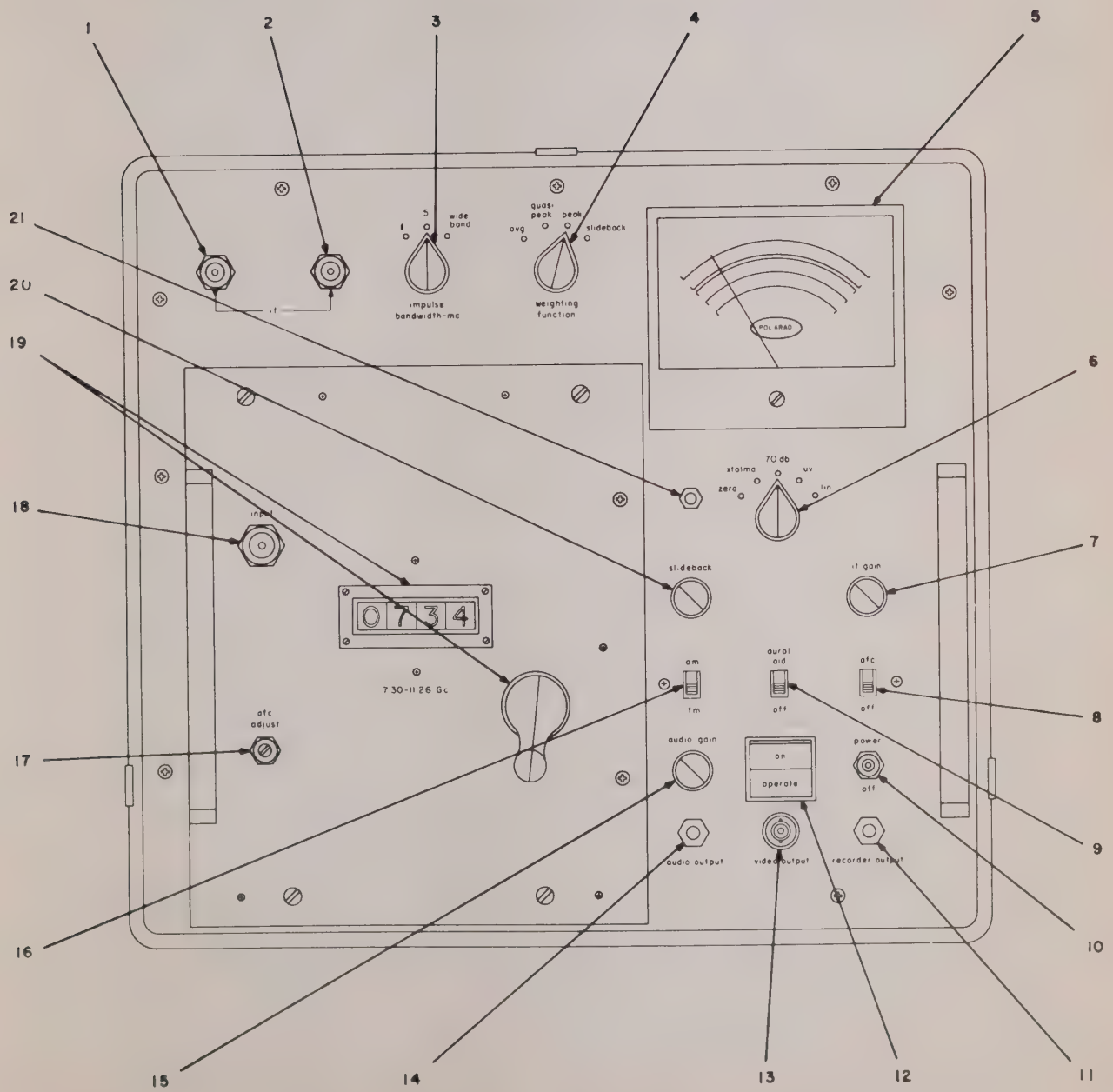


Figure 2-3. Operating Controls, Indicators, and Connectors

TABLE 2-1. FRONT PANEL OPERATING CONTROLS, INDICATORS, AND CONNECTORS

Operating Control, Indicator, or Connector	Figure 2-3 Index Number	Function
IF output connector	1	Front panel connector at which the 140-mc i-f signal is available
IF input connector	2	Front panel connector which returns the i-f signal to the receiver
IMPULSE BANDWIDTH-MC switch	3	Permits setting the impulse bandwidth of the 40-mc i-f signal at 1 mc, 5 mc, or wideband (8 mc)
WEIGHTING FUNCTION	4	Permits selection of the type of measurement to be made by the receiver, as follows: AVG-the average value of the applied r-f signal is measured; QUASI PEAK - the nuisance value of an applied pulsed r-f signal is measured; PEAK - the peak value of an applied pulsed r-f signal is measured; SLIDEBACK - the peak value of an applied pulsed r-f signal having a low duty cycle is measured by the slideback technique (in conjunction with the SLIDEBACK and AUDIO GAIN controls
Output meter	5	Indicates the value of the applied r-f signal under measurement
Scale Selector switch	6	Permits selection of the voltmeter range, as follows: ZERO - permits zero-setting the output meter pointer at the CAL mark (in conjunction with the Zero control); XTAL MA - permits monitoring of the tuning unit first crystal mixer current; 70 DB - permits the measurement of applied r-f signals over a 70-db dynamic range; μV - permits the determination of the absolute value of applied

(Cont'd)

TABLE 2-1. FRONT PANEL OPERATING CONTROLS, INDICATORS, AND CONNECTORS (Cont'd)

Operating Control, Indicator, or Connector	Figure 2-3 Index Number	Function
Scale Selector switch (Cont'd)		r-f signals, provided that the receiver is first calibrated; LIN - permits linear measurement of r-f signals over a 20-db dynamic range
IF GAIN control	7	Permits adjustment of the overall receiver gain and is used when calibrating the system
AFC OFF switch	8	When set to AFC, this switch enables the circuitry which automatically compensates for the frequency drift of the applied r-f signal
AURAL AID OFF	9	When set to AURAL AID, this switch enables the 1-kc oscillator circuitry which facilitates the aural indication of applied r-f signals by amplitude-modulation of the 120-mc output of the crystal-controlled local oscillator
POWER OFF	10	When set to POWER, this switch couples operating power to the Model TR
RECORDER OUTPUT	11	Front panel connector at which the meter signal is available for monitoring on an external 100KΩrecorder
ON OPERATE indicator	12	ON section of this indicator light immediately upon application of operating power; OPERATE section lights approximately 75 seconds later and indicates beam voltage is applied to the reflex klystron
VIDEO OUTPUT connector	13	Front panel connector at which the detected 40-mc i-f signal is available for application to an external oscilloscope for analysis

(Cont'd)

TABLE 2-1. FRONT PANEL OPERATING CONTROLS, INDICATORS, AND CONNECTORS (Cont'd)

Operating Control, Indicator, or Connector	Figure 2-3 Index Number	Function
VIDEO OUTPUT connector		of the modulation content of the applied r-f signal
AUDIO OUTPUT connector	14	Front panel connector at which the audio modulation content of the applied r-f signal and/or 1-kc aural aid signal is available for monitoring on an external 600-ohm headset
AUDIO GAIN control	15	Permits adjustment of the aural signal level available at the AUDIO OUTPUT connector
AM FM switch	16	Couples the output of either the Fm/Afc Amplifier or the 40-mc i-f amplifier to both the AUDIO OUTPUT and VIDEO OUTPUT connectors
AFC ADJUST control	17	Front panel screwdriver control for adjusting the afc error signal level
INPUT connector	18	Front panel connector for coupling the r-f signal to be measured to the Model TR
Tuning control and digital Frequency indicator	19	Tunes the Model TR to the frequency indicated on the digital-readout Frequency indicator
SLIDEBACK control	20	Permits evaluation of the peak value of low duty cycle r-f signals by the slideback technique (inconjunction with the AUDIO GAIN control)
Zero control	21	Permits zero-setting the output meter pointer at the CAL mark when the Scale Selector switch is set to ZERO

d. Turn each of the four captive-lock fasteners on the tuning unit front panel one-quarter turn counter-clockwise and carefully slide the tuning unit from the basic unit.

e. Set 115/230V switch S9 (located on the right side of the bracket supporting J1106 in the basic unit well) and Ac/Dc switch S8 (located at the rear of the basic unit) to the positions corresponding to the nature of the power source, as indicated in table 2-2.

TABLE 2-2. PROPER SETTINGS OF S8 AND S9 AS A FUNCTION OF POWER SOURCE

Nature of Power Source	Set 115/230V Switch S9 to	Set Ac/Dc Switch S8 to
115 volts, 50 to 1000 cps	115V (up)	Ac (down)
230 volts, 50 to 1000 cps	230V (down)	Ac (down)
-12 volts	-	Dc (up)

f. Replace the tuning unit into the basic unit.

g. Couple the Model TR to the source of operating power.

Note

Note the polarity marking of J7 and J8 when connecting -12 volts to the Model TR. The equipment will not operate if proper polarity is not observed.

h. Set the POWER OFF switch to POWER. The ON indicator will immediately light upon application of operating power; the OPERATE indicator will light approximately 75 seconds later. Allow the Model TR to warm up for at least 15 minutes before making any measurements.

i. Connect I-f Cable Assembly W13 as a jumper between the IF output and IF input connectors.

j. Set the WEIGHTING FUNCTION switch to AVG.

k. Set the Scale Selector switch to ZERO. Adjust the Zero control, if necessary, to obtain an Output meter pointer indication of CAL.

2-9. MEASURING THE RELATIVE POWER LEVELS OF R-F SIGNALS. The 70 DB position of the Scale Selector switch is employed when evaluating the relative power level of r-f signals having the same frequency (i.e., when making antenna pattern measurements, VSWR measurements, and determining filter characteristics). The procedure for making relative power level measurements is described in the following steps:

a. Apply operating power to the Model TR as described in paragraph 2-8.

b. Set the WEIGHTING FUNCTION switch to AVG.

c. Set the AFC OFF switch to OFF.

d. Set the AM FM switch to AM.

e. Set the IMPULSE BANDWIDTH-MC switch to 1.

f. Set the Scale Selector switch to 70 DB.

g. Adjust the IF GAIN control to obtain an Output meter pointer indication of CAL. The gain of the receiver is now standardized by means of the front-end noise.

h. Connect a 600-ohm headset to the AUDIO OUTPUT connector.

i. Set the AURAL AID OFF switch to AURAL AID.

j. Rotate the AUDIO GAIN control midway between its extreme settings.

k. Connect R-f Cable Assembly W31 between the source of the r-f signal under measurement and the INPUT connector.

l. Rotate the Tuning control throughout the band in search of the applied r-f signal. When the Output meter pointer deflects sharply to an indication greater than CAL, or when a 1-kc aural indication is heard from the headset, the Model TR is tuned to the frequency of the applied r-f signal. Note the indication of the digital-readout Frequency indicator.

m. Set the AURAL AID OFF switch to OFF.

n. The relative value of applied r-f signals is read directly from the 70 DB scale.

2-10. MEASURING THE AVERAGE VALUE OF APPLIED R-F SIGNALS. The AVG position of the WEIGHTING FUNCTION switch is employdd to determine the average value of a narrow-band r-f signal (i.e., cw or audio-modulated cw). Two methods are available for this type of measurement. The first, the r-f substitution technique, is described in paragraph 2-11. The second, the full-scale calibration technique, is described in paragraph 2-12.

2-11. R-f Substitution Techique. To determine the average value of an applied r-f signal by the r-f substitution technique, proceed as described in the following steps:

a. Apply operating power to the Model TR as desribed in paragraph 2-8.

b. Set the WEIGHTING FUNCTION switch to AVG.

c. Set the AFC OFF switch to OFF.

d. Set the AM FM switch to AM.

e. Set the IMPULSE BANDWIDTH-MC switch to 1.

f. Set the Scale Selector switch to 70 DB.

g. Adjust the IF GAIN control to obtain an Output meter pointer indication of CAL.

h. Connect a 600-ohm headset to the AUDIO OUTPUT connector.

i. Set the AURAL AID OFF switch to AURAL AID.

j. Rotate the AUDIO GAIN control midway between its extreme settings.

k. Connect R-f Cable Assembly W31 between the source of the applied r-f signal under measurements and the INPUT connector.

l. Rotate the Tuning control throughout the band in search of the applied r-f signal. When the Output meter pointer deflects sharply to an indication greater than CAL, or when a 1-kc aural indication is heard from the headset, the Model TR is tuned to the frequency of the applied r-f signal. Note the indication of the digital-readout Frequency indicator.

m. Set the AURAL AID OFF switch to OFF.

n. Adjust the IF GAIN control to position the Output meter pointer directly on the nearest calibration mark of the 70 DB scale. Note this scale marking.

o. Replace the source of the r-f signal under measurement with a calibrated microwave signal generator capable of producing a cw output at the frequency indicated on the digital-readout Frequency indicator.

p. With the calibrated microwave signal generator adjusted for a cw output of approximately -40 dbm, fine-tune the signal generator to peak the Output meter pointer indication. The calibrated microwave signal generator is now tuned to the same frequency as is the Model TR.

q. Calibrate the microwave signal generator at the frequency to which it is tuned and then adjust its output level to obtain the same Output meter pointer indication as in step 1, above.

r. Note the output level of the calibrated microwave signal generator. This level is equal to the average value of the applied r-f signal under measurement.

2-12. Full-Scale Calibration Technique. To determine the average value of an applied r-f signal by the full-scale calibration technique, proceed as described in steps a through 1 of paragraph 2-11. Then proceed as described in the following additional steps:

a. Replace the source of the r-f signal under measurement with a calibrated microwave signal generator capable of producing a cw output at the frequency indicated on the digital-readout Frequency indicator.

b. With the calibrated microwave signal generator adjusted for a cw output of approximately -40 dbm, fine-tune the signal generator to peak the Output meter pointer indication. The calibrated microwave signal generator is now tuned to the same frequency as is the Model TR.

c. Calibrate the microwave signal generator at the frequency to which it is tuned and then adjust its attenuator control to obtain a cw output level of 1,000 microvolts.

d. Set the Scale Selector switch to μV.

e. Adjust the IF GAIN control to obtain an Output meter pointer indication of 1000 on the μV RF scale. The μV RF scale is now calibrated.

f. Without further adjustment of any controls, replace the calibrated microwave signal generator with the source of the r-f signal under measurement.

g. Note the Output meter pointer indication on the μV RF scale. The average value of the applied r-f signal under measurement is read directly in microvolts from this scale.

2-13. MEASURING THE QUASI PEAK VALUE OF APPLIED PULSED R-F SIGNALS. The QUASI PEAK position of the WEIGHTING FUNCTION switch is employed to determine the nuisance value of an applied pulsed r-f signal. The greater the duty cycle of the applied pulsed r-f signal (for constant signal amplitude), the greater the output meter pointer indication. To determine the quasi peak value of applied pulsed r-f signals, proceed as described in the following steps:

a. Apply operating power to the Model TR as described in paragraph 2-8.

b. Set the WEIGHTING FUNCTION switch to QUASI PEAK.

c. Set the AFC OFF switch to OFF.

d. Set the AURAL AID OFF switch to OFF.

e. Set the AM FM switch to AM.

f. Set the IMPULSE BANDWIDTH-MC switch to either 1 or 5.

g. Set the Scale Selector switch to μV.

h. Adjust the IF GAIN control to obtain an output meter pointer indication of 5 on the μV RF scale.

i. Connect a 600-ohm headset to the AUDIO OUTPUT connector.

j. Rotate the AUDIO GAIN control midway between its extreme settings.

k. Connect R-f Cable Assembly W31 between the source of the pulsed r-f signal under measurement and the INPUT connector.

l. Rotate the Tuning control throughout the band in search of the applied pulsed r-f signal. When the Output meter pointer deflects sharply to an indication greater than 5 on the μV RF scale, or when an aural indication due to the prf of the applied pulsed r-f signal is heard from the headset, the Model TR is tuned to the frequency of the applied pulsed r-f signal. Note the indication of the digital-readout Frequency indicator.

m. Replace the source of the pulsed r-f signal under measurement with a calibrated microwave signal generator capable of producing a cw output at the frequency indicated on the digital-readout Frequency indicator.

n. With the calibrated microwave signal generator adjusted for a cw output of approximately -40 dbm, fine-tune the signal generator to peak the Output meter pointer indication. The calibrated microwave signal generator is now tuned to the same frequency as is the Model TR.

o. Calibrate the microwave signal generator at the frequency to which it is tuned and then adjust its attenuator control to obtain a cw output level of 1, 000 microvolts.

p. Adjust the IF GAIN control to obtain an Output meter pointer indication of 1000 on the μV RF scale. The μV RF, DB ABOVE 1 μV/MC, and DB ABOVE 1 μV/5MC scales are now calibrated.

q. Without further adjustment of any controls, replace the calibrated microwave signal generator with the source of the pulsed r-f signal under measurement.

r. Note the Output meter pointer indication. The quasi peak value of the applied pulsed r-f signal is indicated directly in decibels above 1 microvolt per megacycle (for an IMPULSE BANDWIDTH-MC switch setting of 1), and in decibels above 1 microvolt per 5 megacycles (for an IMPULSE BANDWIDTH-MC switch setting of 5).

Note

Further evaluation of the nature of the applied pulsed r-f signal may be accomplished through the use of the AVG and PEAK positions of the WEIGHTING FUNCTION switch.

2-14. MEASURING THE PEAK VALUE OF PULSED R-F SIGNALS BY THE DIRECT TECHNIQUE. The PEAK position of the WEIGHTING FUNCTION switch is employed to determine the peak value of applied pulsed r-f signals. To determine the peak value of applied pulsed r-f signals, proceed as described in the following steps:

a. Apply operating power to the Model TR as described in paragraph 2-8.

b. Set the WEIGHTING FUNCTION switch to PEAK.

c. Set the AFC OFF switch to OFF.

d. Set the AURAL AID OFF switch to OFF.

e. Set the AM FM switch to AM.

f. Set the IMPULSE BANDWIDTH-MC switch to either 1 or 5.

g. Set the Scale Selector switch to μV.

h. Adjust the IF GAIN control to obtain an output meter pointer indication of 5 on the μV RF scale.

i. Connect a 600-ohm headset to the AUDIO OUTPUT connector.

j. Rotate the AUDIO GAIN control midway between its extreme settings.

k. Connect R-f Cable Assembly W31 between the source of the pulsed r-f signal under measurement and the INPUT connector.

l. Rotate the Tuning control throughout the band in search of the applied pulsed r-f signal. When the Output meter pointer deflects sharply to an indication greater than 5 on the μV RF scale, or when an aural indication due to the prf of the applied pulsed r-f signal is heard from the headset, the Model TR is tuned to the frequency of the applied pulsed r-f signal. Note the indication of the digital-readout Frequency indicator.

m. Replace the source of the pulsed r-f signal under measurement with a calibrated microwave signal generator capable of producing a cw output at the frequency indicated on the digital-readout Frequency indicator.

n. With the calibrated microwave signal generator adjusted for a cw output of approximately 500 microvolts, fine-tune the signal generator to peak the Output meter pointer indication. The calibrated microwave signal generator is now tuned to the same frequency as is the Model TR.

o. Calibrate the microwave signal generator at the frequency to which it is tuned and then adjust its attenuator control to obtain a cw output level of 1, 000 microvolts.

p. Adjust the IF GAIN control to obtain Output meter pointer indication of 1000 on the μV RF scale. The μV RF, DB ABOVE 1 μV/MC, and DB ABOVE 1 μV/5MC scales are now calibrated.

q. Without further adjustment of any controls, replace the calibrated microwave signal generator with the source of the pulsed r-f signal under measurement.

r. Note the Output meter pointer indication. The peak value of the applied pulsed r-f signal is indicated directly in decibels above 1 microvolt per megacycle

(for an IMPULSE BANDWIDTH-MC switch setting of 1), and in decibels above 1 microvolt per 5 megacycles (for an IMPULSE BANDWIDTH-MC switch setting of 5).

2-15. MEASURING THE PEAK VALUE OF PULSED R-F SIGNALS BY THE SLIDEBACK TECHNIQUE. The SLIDEBACK position of the WEIGHTING FUNCTION switch is employed to determine the peak value of low duty cycle pulsed r-f signals by the slideback technique. To determine the peak value of such r-f signals, proceed as described in steps a through q of paragraph 2-14. Then proceed as described in the following additional steps:

a. Set the WEIGHTING FUNCTION switch to SLIDEBACK.

b. Rotate the SLIDEBACK control fully counterclockwise. The aural indication due to the prf of the applied pulsed r-f signal will be heard in the headset.

c. Carefully rotate the SLIDEBACK control slowly clockwise. Note that the aural indication decreases is strength. As it does, adjust the AUDIO GAIN control to keep the indication at an audible level. Continue rotating the SLIDEBACK control clockwise until the aural indication just vanishes.

d. Note the Output meter pointer indication. The peak value of the applied pulsed r-f signal, as determined by the slideback technique, is indicated directly in decibels above 1 microvolt per megacycle (for an IMPULSE BANDWIDTH -MC switch setting of 1), and in decibels above 1 microvolt per 5 megacycles (for an IMPULSE BANDWIDTH -MC switch setting of 5).

2-16. STOPPING PROCEDURE. To de-energize the Model TR, simply set the POWER OFF switch to OFF and disconnect the equipment from the source of operating power.

2-17. PACKAGING INSTRUCTIONS.

2-18. PACKAGING FOR SHORT TERM STORAGE. If the Model TR is to be stored for a relatively short period, cover it with a suitable protective covering such as a sheet of plastic or paper. Put the accessories and instruction manual in a carton or bag and fasten it to the unit to prevent loss. Store the Model TR in a clean and dry area where it will not be subject to extreme temperatures.

2-19. PACKAGING FOR LONG TERM STORAGE OR SHIPMENT. If the Model TR is to be stored for a long period of time, or shipped, proceed as follows:

a. If the original wrappings and carton have been saved, package the equipment as shown in figure 2-4.

b. If new packing materials are to be used, assemble the necessary wrappings and carton.

c. Wrap the equipment in a moisture- and vapor-proof barrier such as plastic or water-proof paper.

d. Wrap the accessories and instruction manual in a moisture- and vapor-proof barrier.

e. Place the package in a suitable carton. Fill all empty spaces in the carton with suitable packing to prevent shifting of the packages within the carton.

f. Seal and mark the carton.

g. If the storage or shipping conditions make it necessary, enclose the carton within an outer carton or wooden box.

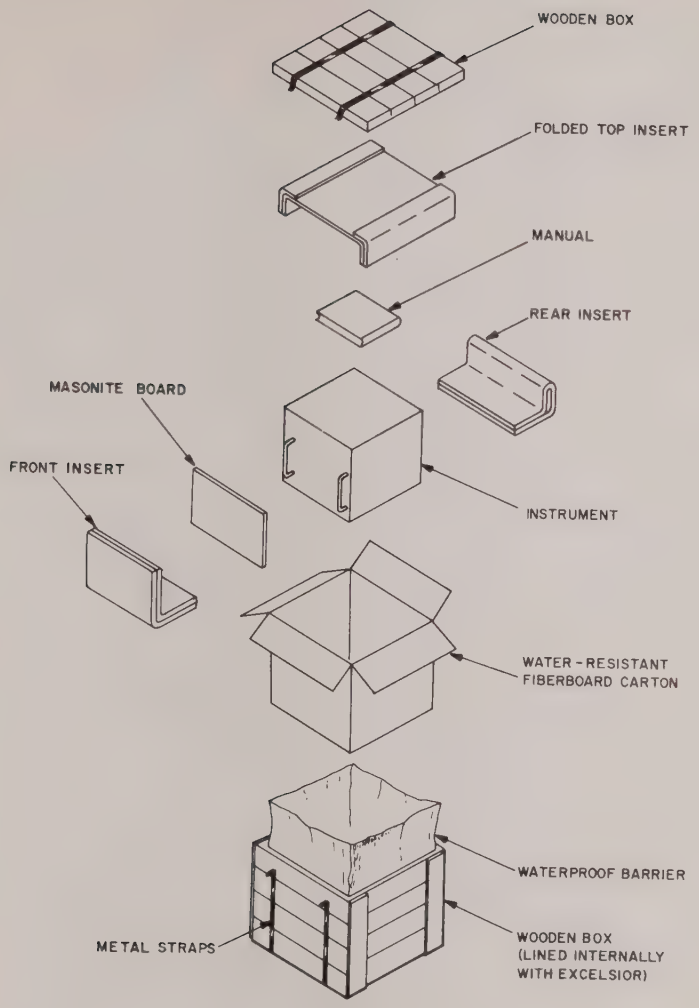


Figure 2-4. Packaging Diagram

SECTION III

THEORY OF OPERATION

3-1. GENERAL.

3-2. The Model TR Microwave Receiver is a sensitive, frequency-selective, triple-conversion superheterodyne receiver covering the input signal frequency range from 0.95 to 11.26 gc in four overlapping bands. It is employed as a sensitive test instrument permitting the comparative voltage (power) levels of applied r-f signals to be determined. In addition to the conventional microwave receiver circuitry, the Model TR also contains:

a. An r-f preselector, physically contained within each tuning unit, and a high-frequency first i-f to ensure adequate image and spurious response rejection;

b. Automatic frequency control (afc) to compensate for applied signal and/or klystron first local oscillator drift;

c. Automatic gain control (agc) to provide an adequate dynamic range;

d. Weighting circuits for the measurement of the average, quasi-peak, or peak values of applied r-f signals;

e. A calibrated output voltmeter having six scales;

f. An aural tuning aid to facilitate the detection of unmodulated and/or low-level r-f signals;

g. Audio, video, and recorder outputs;

3-3. SIMPLIFIED BLOCK DIAGRAM ANALYSIS.

(See figure 3-1).

3-4. The r-f signal under measurement is coupled through the INPUT connector of the tuning unit and applied to a two-cavity preselector. The portion of the signal that falls within the pass-band of the preselector is applied to a first crystal mixer simultaneously with the r-f output of a klystron first local oscillator. The frequency difference between these two signals is maintained at 260 mc and the non-linear characteristics of the mixer generates the sum and difference frequencies of these signals and their harmonics.

3-5. The 260-mc difference frequency is coupled through a 255-mc high-pass filter to a 260/140-mc low-noise preamplifier. All spurious responses are attenuated by the filter and are prevented from application to the remainer of the i-f circuitry. The 260/140-mc low-noise preamplifier amplifies the first i-f signal and mixes it with the 120-mc output of a crystal-controlled local oscillator, thereby generating a second i-f signal at 140 mc. This signal is applied to a 140-40-mc i-f amplifier through an adjustable bandwidth band-pass filter.

3-6. After amplification within the 140/40-mc i-f amplifier, the second i-f signal is mixed with the 180-mc output of the crystal-controlled oscillator to develop the third and final i-f signal at 40 mc. This signal is coupled through an adjustable bandwidth band-pass filter that determines the impulse bandwidth of the system. The 40-mc signal is amplified within a 40-mc i-f amplifier, and a portion of this signal is applied to an fm/afc amplifier (refer to paragraph 3-8). The remainder of the signal is detected and routed to two amplifiers; one supplying the weighting circuits within a peak detector/metering amplifier (refer to paragraph 3-7) and the other supplying both an audio amplifier and the VIDIO OUTPUT connector (refer to paragraph 3-9).

3-7. That portion of the detected signal applied to the peak detector/metering amplifier is coupled through a weighting network (determined by the setting of the WEIGHTING FUNCTION switch) that provides an output proportional to the type of measurement selected (i.e., average, quasi-peak, or peak). The resulting signal is coupled through a difference amplifier to both the output meter and RECORDER CUTPUT front panel connectors; the former providing a visual indication of the level of the applied r-f signal under measurement and the latter permitting simultaneous recording of the output meter reading on an external recorder.

3-8. The 40-mc i-f signal applied to the fm/afc amplifier drives an afc discriminator. Frequency drift of either the applied r-f signal or the klystron first local oscillator output results in a shifting of the i-f signal frequency. The fm/afc amplifier senses this frequency shift and develops a d-c error voltage proportional to the frequency deviation from the desired 40 mc. This d-c voltage is coupled to the reflector voltage power supply (when the AFC OFF switch is set to AFC), thereby adjusting the reflector voltage applied to the klystron first local oscillator and causing the operating frequency of the reflex klystron to shift in a direction that will maintain the third i-f signal at 40 mc. The fm/afc amplifier simultaneously recovers the modulation content of applied frequency-modulated r-f signals for application to both the audio amplifier and VIDEO OUTPUT connector (refer to paragraph 3-9).

3-9. The recovered modulation content of the applied r-f signal is coupled through the AM FM switch and applied simultaneously to both the VIDEO OUTPUT and the audio amplifier. The former permits monitoring of the modulation through the use of an external oscilloscope. The latter, in conjunction with the AUDIO GAIN control, permits monitoring of the modulation through the use of an external 600-ohm headset plugged into the AUDIO OUTPUT connector.

3-10. The detection of unmodulated and/or low-level applied r-f signals is facilitated through a 1-kc aural tuning aid oscillator. Setting the AURAL AID OFF switch to AURAL AID energizes the aural tuning aid oscillator, thereby amplitude-modulating the 120-mc output of the crystal-controlled local oscillator with a 1-kc tone. This injected modulation is recovered and monitored through the AUDIO OUTPUT and/or VIDEO OUTPUT connectors.

3-11. DETAILED THEORY OF OPERATION, TUNING UNITS. (See figures 3-2 and 5-1 through 5-4).

3-12. The four tuning units employed in the Model TR system are identical in principles of operation. Differences exist, due to the frequency range of each tuning unit, in the types of reflex-klystron tubes and first crystal mixers employed. In addition, mode switching is employed in the Models T-RM and T-RX Tuning Units to avoid the necessity of a higher reflector supply voltage. Table 3-1 is a convenient listing of the differences between these tuning units. The reader should refer to the individual detailed tuning unit schematic diagrams (figures 5-1 through 5-4) to note actual circuit differences. Paragraphs 3-13 through 3-24 describe the Model T-RX Tuning Unit.

3-13. PRESELECTOR Z1501. Preselector Z1501 (See figures 3-2 and 5-4) consists of two aperture-coupled cavities acting as a 9/4-wavelength resonant line (double-tuned filter) at the input of the tuning unit. The preselector is tuned, by means of the Tuning control and precision mechanical drive system (refer to paragraph 3-22), to the frequency indicated on the digital-readout Frequency indicator. Fine adjustment of the two preselector tuning plungers (one for each cavity) is accomplished by two tape cams mounted on a rack and gear assembly above the preselector. This fine tuning capability insures precise incremental tuning of the preselector at all points within the tuning unit operating band.

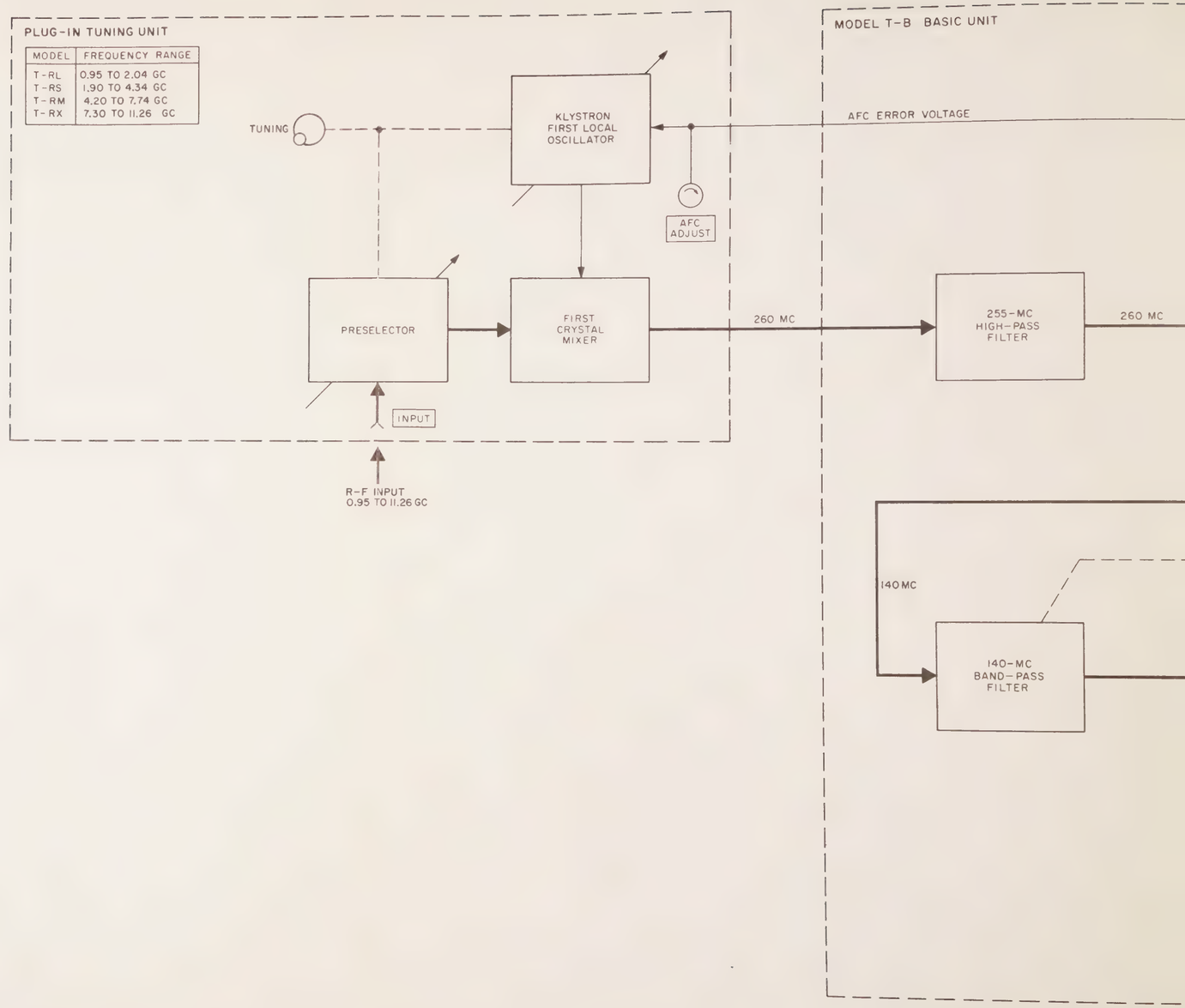
3-14. KLYSTRON FIRST LOCAL OSCILLATOR V1501. Klystron first local oscillator V1501 (see figures 3-2 and 5-4) is a reflex klystron tube operating in an external resonant cavity. The cavity is in the form of a coaxial transmission line and consists of two cylinders . . . . . one inside the other (see figure 3-3). The reflex klystron is inserted at one end of the cavity so that the outer cylinder contacts the first interaction grid (so termed because it is closer to the cathode) ring of the tube. The spring fingers of the inner cylinder contact the second interaction grid ring. The circuit is completed at the other end of the cavity by a movable, non-contacting shorting plunger of special construction. The position of this movable short determines the physical wavelength (hence the resonant frequency) of the cavity. The reflector voltage, which determines the exact electrical frequency of operation of the reflex klystron oscillator, is tracked (refer to paragraph 3-15) with the movement of the shorting plunger by means of the precision mechanical drive system (refer to paragraph 3-22). Local oscillator output power is extracted from the cavity, by loop coupling at a single fixed point, and applied to the first crystal mixer (refer to paragraph 3-18).

3-15. REFLECTOR VOLTAGE TRACKING CIRCUITRY. Proper operation of the klystron first local oscillator requires that the applied reflector (reflector-to-cathode) voltage be tracked with the position of the tuning plungers. Reflector voltage tracking is accomplished by tracking potentiometer R1505 and associated circuitry in conjunction with the precision mechanical drive system.

3-16. When operating in the lower portion of the band, the voltage applied to the reflector of V1501 causes the reflex klystron tube to operate in the 3 3/4-wave reflector mode (see figure 3-4). Operation of the oscillator at higher frequencies requires that the magnitude of the applied reflector voltage be increased (and vice versa). In the vicinity of 8.98 gc, the magnitude of the reflector voltage becomes rather high and, at the same time, the output power of the reflex klystron decreases. Mode switch S1501, which is actuated by a cam mounted on the shaft of R1505, changes the applied reflector voltage to a lower value, thereby causing the reflex klystron to operate in the next higher (4 3/4-wave) reflector mode. This mode is employed through the remainder of the band (8.98 to 11.00 gc).

3-17. The maximum and minimum voltages applied to the tracking potentiometers are obtained from the beam voltage and reflector voltage supplies via screwdriver adjusted potentiometers R1504 (Low Adj), R1506 (High Adj), R1507 (Track 1), and R1509 (Track 2).

3-18. FIRST CRYSTAL MIXER CR1501. Both that portion of the r-f signal under measurement falling within the pass-band of the preselector and the output of the klystron first local oscillator are simultaneously applied to first crystal mixer CR1501 (see figures 3-2 and 5-4). The non-linear characteristics of the crystal diode generates the sum and difference frequencies of these signals, as well as the sum and difference frequencies of all their harmonics, which are coupled to the input of the 255-mc high-pass filter (refer to paragraph 3-27).


PLUG-IN TUNING UNIT
MODEL | FREQUENCY RANGE
T-RL | 0.95 TO 2.04 GC
T-RS | 1.90 TO 4.34 GC
T-RM | 4.20 TO 7.74 GC
T-RX | 7.30 TO 11.26 GC
TUNING
KLYSTRON FIRST LOCAL OSCILLATOR
AFC ADJUST
PRESELECTOR
FIRST CRYSTAL MIXER
INPUT
R-F INPUT
0.95 TO 11.26 GC
MODEL T-B BASIC UNIT
AFC ERROR VOLTAGE
260 MC
255-MC HIGH-PASS FILTER
260 MC
140 MC
140-MC BAND-PASS FILTER

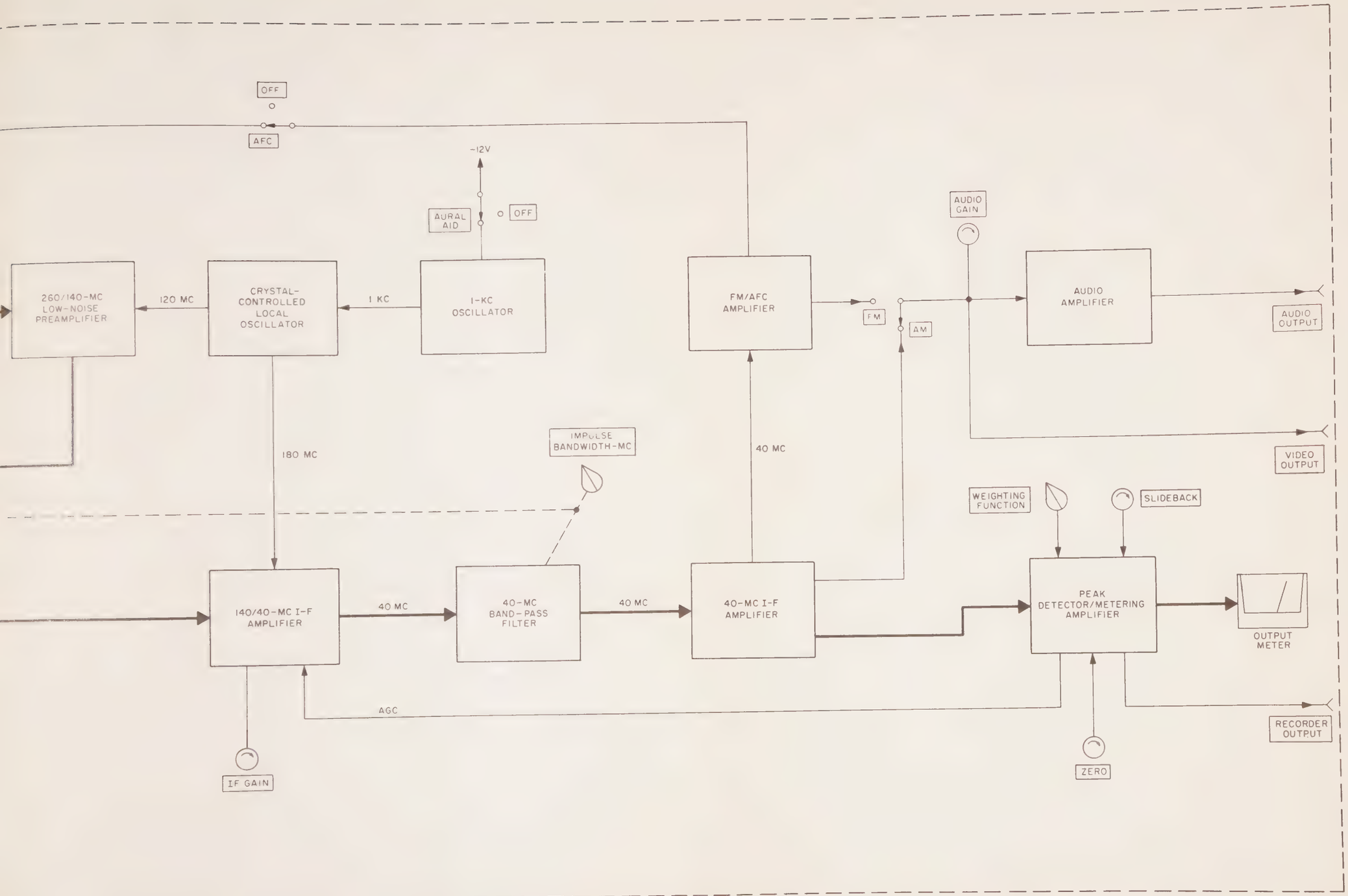


Figure 3-1. Model TR Microwave Receiver, Simplified Block Diagram

MODEL T-B BASIC UNIT

PLUG-IN TUNING UNIT

MODEL	FREQUENCY (GC)	REF SYM SERIES
T-RL	0.95 TO 2.04	1200
T-RS	1.90 TO 4.34	300
T-RM	4.20 TO 7.74	1400
T-RX	7.30 TO 11.26	1500

(SEE FIGURES 5-1 THROUGH 5-4 FOR SCHEMATIC DIAGRAMS)

TUNING

AFC ADJUST R__12

FIRST LOCAL OSCILLATOR V__01

PRESELECTOR Z__01

FIRST MIXER CR_ _01

INPUT Z_ _01

P201

W9

BEAM AND REFLECTOR VOLTAGES

255-MC HIGH-PASS FILTER

P4501 J4501 J4502 P4502

(SEE FIGURE 5-5 FOR SCHEMATIC DIAGRAM)

260 MC

W12

P201 J201

260/140-MC LOW-NOISE PREAMPLIFIER

(SEE FIGURE 5-6 FOR SCHEMATIC DIAGRAM)

260-MC AMPLIFIER V201

260-MC AMPLIFIER V202

SECOND MIXER CR201

140-MC AMPLIFIER Q201

P202 J202

J203 P203

W1

120 MC

P302 J302

120-MC POWER AMPLIFIER Q305

120-MC BAND-PASS FILTER

120 MC

180-MC POWER AMPLIFIER Q306

120-MC BAND-PASS FILTER

180 MC

J301 P301

W14

140 MC

IMPULSE BANDWIDTH-MC S4201

POSITION	BANDWIDTH
1	1 MC
2	5 MC
3	WIDE BAND

P4205 J4205

140-MC NARROW-BAND FILTER

140-MC WIDE-BAND FILTER

S4201-4

S4201-5

J4204 P4204

140-MC SECTION OF 140/40-MC BAND-PASS FILTER

(SEE FIGURE 5-7 FOR SCHEMATIC DIAGRAM)

W11

P103 J103

140/40-MC I-F AMPLIFIER

(SEE FIGURE 5-8 FOR SCHEMATIC DIAGRAM)

P101 J101 TP101

140-MC I-F AMPLIFIER Q101

140-MC I-F AMPLIFIER Q102

140-MC I-F AMPLIFIER Q103

140-MC I-F AMPLIFIER Q104

140 MC

THIRD MIXER Q105

40 MC

40-MC I-F AMPLIFIER Q106

40-MC I-F AMPLIFIER Q107

W8

IF GAIN R21

IF OUTPUT J2

IF INPUT J1

P2 P1

W13

180 MC W2

S4201-1

W5 40

P102 J102

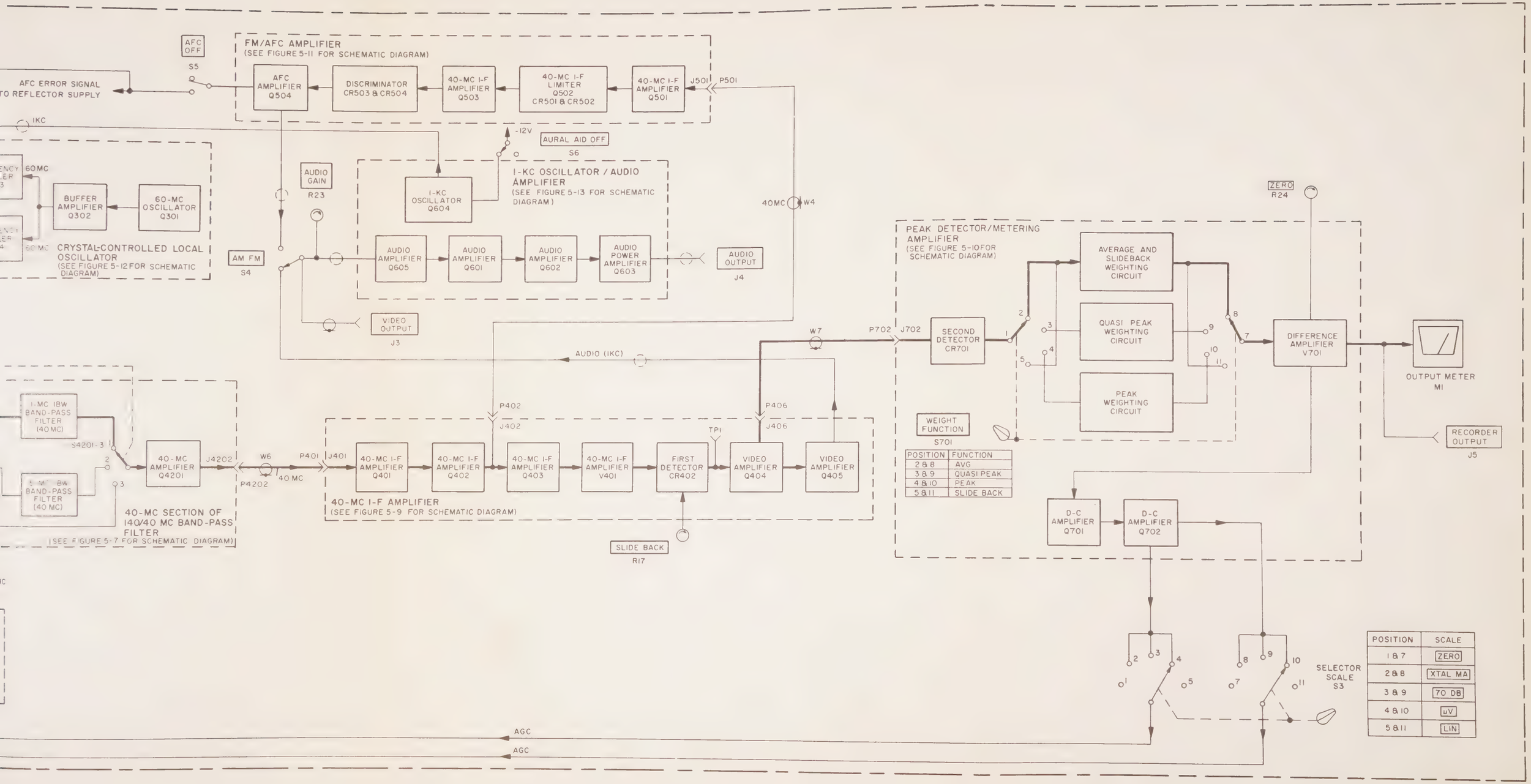


Figure 3-2. Model TR Microwave Receiver, Detailed Block Diagram

Table 3-1. Tuning Unit Difference Data

Characteristic	Tuning Unit			
	Model T-RL	Model T-RS	Model T-RM	Model T-RX
Frequency range	0.95 to 2.04 gc	1.90 to 4.34 gc	4.20 to 7.74 gc	7.30 to 11.26 gc
Klystron first local oscillator frequency range	1.21 to 2.30 gc (260 mc above Frequency indicator reading)	2.16 to 4.60 gc (260 mc above Frequency indicator reading)	4.46 to 8.00 gc (260 mc above Frequency indicator reading)	7.04 to 11.00 gc (260 mc below Frequency indicator reading)
Klystron first local oscillator tube type	ZV1010/7505	ZV1009/7049	ZV1011/8052	ZV1011/8052
First local oscillator cavity mode	1/4 λ	3/4 λ	3/4 λ	3/4 λ
Preselector cavity mode	1/4 λ	3/4 λ	3/4 λ	9/4 λ
Reflector mode switching	Not required	Not required	Required	Required
Klystron first local oscillator reflector mode	2 3/4 λ	2 3/4 λ	2 3/4 λ from 4.46 to 5.78 gc; 3 3/4 λ from 5.78 to 8.00 gc	3 3/4 λ from 7.04 to 8.98 gc; 4 3/4 λ from 8.98 to 11.00 gc
Beam (cathode) voltage	-325 volts	-325 volts	-1250 volts	-1250 volts
Reflector supply voltage	-925 volts	-925 volts	-1850 volts	-1850 volts
Control grid voltage *	+3 to +10 volts	+3 to +10 volts	+3 to +10 volts	+3 to +10 volts
Beam current	28 ma	28 ma	20 ma	20 ma

* With respect to beam (cathode) voltage.

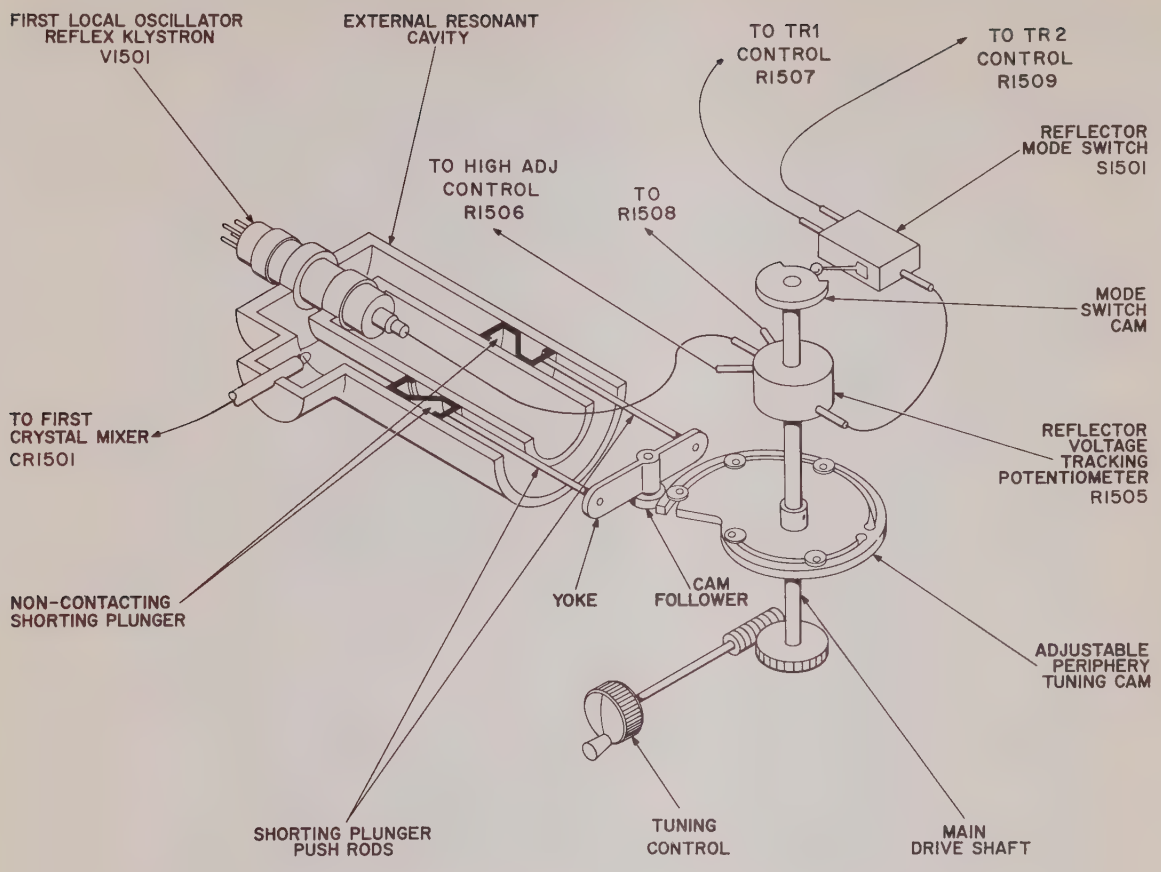


Figure 3-3. Klystron First Local Oscillator V1501, Simplified Electromechanical Diagram

3-19. PROTECTIVE DIODE CR1502. Protective diode CR1502, connected between the reflector and cathode of klystron first local oscillator V1501, is employed to prevent possible damage to the reflex klystron should the reflector become positive with respect to the cathode. Reference to figure 5-4 shows that the phasing of the diode is such that any circuit disturbance causing the reflector to become positive (with respect to the cathode) will bias the diode into conduction. Should such a condition exist, the maximum positive voltage appearing at the reflector will be the small voltage drop across the conducting diode.

3-20. BIAS ADJUST CONTROL R1501. The r-f power developed by klystron first local oscillator V1501 is a function of the current drawn by the tube. Normal operation of the reflex klystron requires a beam current of 20 ma. The control grid bias voltage necessary for the tube to draw this current varies between +3 and +10 volts (with respect to cathode) from tube to tube. Bias Adj control R1501, in conjunction with a +25 volt supply (refer to paragraph 3-81), is provided to adjust the control grid bias voltage to that value which causes the reflex klystron to draw a beam current of 20 ma.

3-21. AFC ADJUST CONTROL R1512. Although AFC ADJUST control R1512 is physically contained within the tuning unit, its function is more closely related to the operation of the fm/afc amplifier. The operation of this control is, therefore, included in the discussion of the fm/afc amplifier (refer to paragraph 3-52).

3-22. PRECISION MECHANICAL DRIVE SYSTEM. The precision mechanical drive system (Unidial®) simultaneously tracks the preselector, first local iscillator reflector voltage, external cavity tuning plunger position, and digital-readout Frequency indicator with rotation of the Tuning control. This drive system consists of a main drive shaft, two tuning cams (one of the adjustable-periphery* type), and precision gear assemblies. Through this drive system the rotational motion imparted to the Tuning control by the operator is converted to the translational motion necessary to track the preselector and external cavity tuning pluger position as well as the rotational motion needed to drive the reflector voltage tracking potentiometer, frequency indicator, and mode switch cam.

*U. S. Patent No. 2, 824, 466.

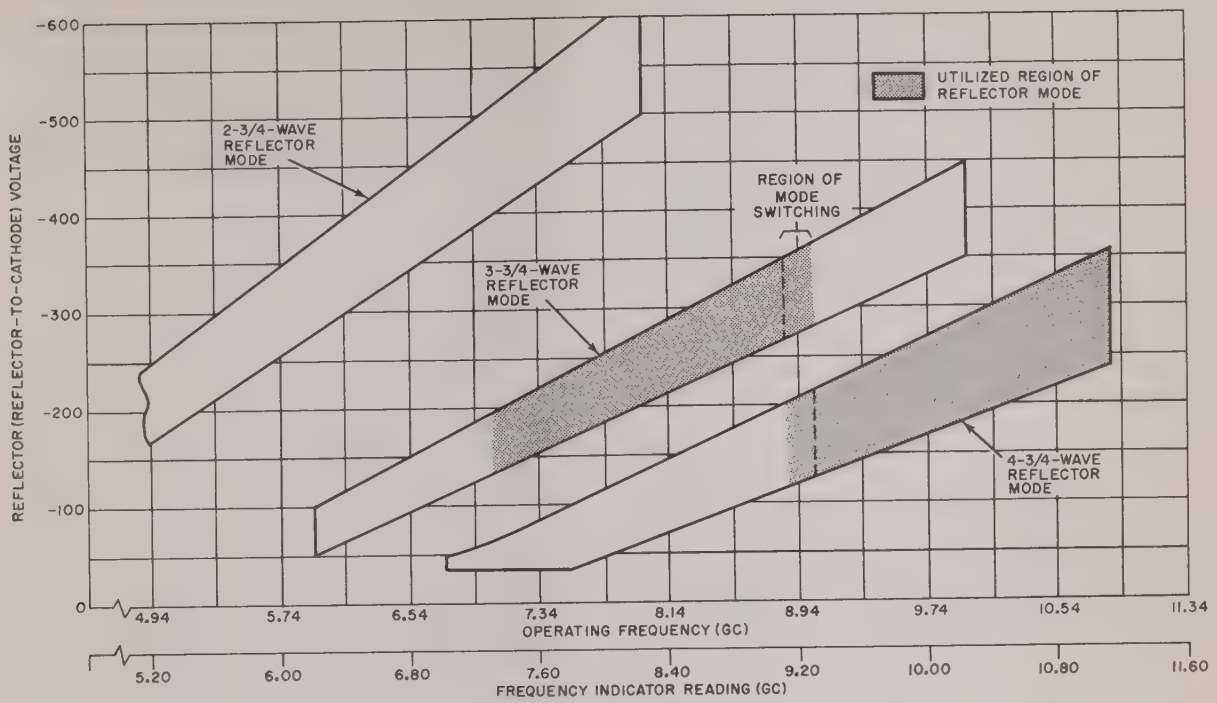


Figure 3-4. Frequency-Reflector Voltage Characteristic Curve, Klystron First Local Oscillator V1501

3-23. Rotation of the fixed periphery preselector tuning cam causes its cam follower to drive the preselector drive yoke. The drive yoke, in turn, adjusts the positions of the two tuning plungers within the preselector cavities, thereby determining the physical wavelength of the preselector.

3-24. In a manner similar to that for the preselector, the adjustable periphery tuning cam adjusts the position of the tuning plunger within the external cavity of the reflex klystron.

3-25. DETAILED THEORY OF OPERATION, BASIC UNIT. (See figures 3-2 and 5-5 through 5-17).

3-26. The basic unit, in addition to being the control and monitoring portion of the Model TR system, contains the circuitry required for the amplification, frequency conversion, detection, and metering of the tuning unit output signal. The individual circuits within the basic unit are described in paragraphs 3-27 through 3-86.

3-27. 255-MC HIGH-PASS FILTER. The 255-mc high-pass filter (see figures 3-2 and 5-5) consists of a high-pass filter network serving to attenuate spurious signals having a frequency below 255-mc and a choke section that provides a d-c return path for the first mixer crystal current.

3-28. The 255-mc high-pass section of the filter consists of three frequency traps, two tuned to 220 mc and the third to 248 mc. The high-frequency characteristics of this filter is controlled by variable capacitors C4501 and C4504. The filtered first i-f output signal is coupled to the 260/140-mc low-noise preamplifier (refer to paragraph 3-29) via i-f cable assembly W12.

3-29. 260/140-MC LOW-NOISE PREAMPLIFIER. The 260/140-mc low-noise preamplifier (see figures 3-2 and 5-6) is a two-stage, grounded-grid 260-mc i-f amplifier followed by a second crystal mixer and 140-mc i-f amplifier. This assembly amplifies the 260-mc first i-f signal obtained from the tuning unit, heterodynes it with a 120-mc signal to yield a 140-mc second i-f, and amplifies this 140-mc signal prior to application to the remainder of the i-f circuitry.

3-30. The 260-mc first i-f signal coupled from the tuning unit through the 255-mc band-pass filter is applied, through J201, to both a low-pass filter and a broadly-tuned i-f impedance matching network. The d-c crystal current component of this signal is bypassed through low-pass filter L201, C201, L202, and C202, coupled through pin H of multipin connector P204 to the Output meter switching circuitry, thereby completing the first crystal mixer d-c return path.

3-31. The 260-mc portion of the input signal undergoes amplification in two low-noise grounded-grid stages. The output of the second stage (V202) is applied to second crystal mixer CR201 simultaneously with the 120-mc output of the crystal-controlled local oscillator (refer to paragraph 3-58), resulting in a heterodyning action that yields the 140-mc second i-f signal. This second i-f signal is amplified by V203 and coupled through J203 to the 140-mc section (refer to paragraph 3-32) of the 140/40-mc band-pass filter.

3-32. 140-MC BAND-PASS FILTER. The 140-mc section (see figures 3-2 and 5-7) consists of two filter networks employed to limit the bandwidth of the 140-mc second i-f signal prior to its application to the 140/40-mc i-f amplifier. The filter inserted in the signal path is determined by the setting of IMPULSE BANDWIDTH-MC switch S4201.

3-33. The 140-mc wide-band filter, whose 3-db bandwidth is set at approximately 16 mc through variable capacitor C4219 and variable inductors L4206 and L4209, is inserted into the 140-mc second i-f line when IMPULSE BANDWIDTH-MC switch S4201 is set to either 5 or WIDEBAND. The filtered output is coupled through i-f output and i-f input connectors J2 and J1, respectively, to the 140/40-mc i-f amplifier (refer to paragraph 3-35).

3-34. Setting S4201 to 1 inserts the 140-mc narrowband filter into the second i-f line. The response of this filter is adjusted, through variable capacitors C4224, C4228, and C4229, to provide a 3-db bandwidth of 3.8 mc.

3-35. 140/40-MC I-F AMPLIFIER. The 140/40-mc i-f amplifier (see figures 3-2 and 5-8) is a four-stage 140-mc i-f amplifier, frequency converter, and two-stage 40-mc i-f amplifier that amplifies the second i-f signal and mixes it with the 180-mc output of the crystal-controlled local oscillator to produce the 40-mc third i-f signal.

3-36. The second i-f output of the 140-mc section of the 140/40-mc band-pass filter is coupled through J101 and undergoes four stages of amplification (Q101 through Q104). This amplified signal is applied to the base of third mixer Q105 and the 180-mc output of the crystal-controlled local oscillator is simultaneously applied to the emitter of Q105. The mixer, operating in the non-linear region, generates the sum and difference frequencies of these two applied signals. Since the collector tank circuit is tuned to the difference frequency, only the desired 40-mc third i-f signal is coupled to the remaining stages. The signal is amplified 40-mc i-f amplifiers Q106 and Q107 and coupled through J102 to the 40-mc section (refer to paragraph 3-38) of the 140/40-mc bandass filter.

3-37. The overall gain of the 140/40-mc i-f amplifier is determined by both IF GAIN control R21 and an agc voltage developed within the peak detector/metering amplifier (refer to paragraph 3-45). The IF GAIN control, in conjunction with the -12 volt supply, adjusts the bias voltage applied to the bases of Q104 and Q105. The action of this control is independent of the setting of Scale Selector switch S3. The agc voltage adjusting the base bias voltage of Q101, Q102, and Q103 is applied only when the Scale Selector switch is set to XTAL MA, 70 DB, or μV.

3-38. 40-MC BAND-PASS FILTER. The 40-mc section (see figures 3-2 and 5-7) of the 140/40-mc bandpass filter contains two filter networks and a single-stage i-f amplifier employed to adjust the impulse bandwidth of the 40-mc third i-f signal and amplify the filtered signal, respectively, prior to application to the 40-mc i-f amplifier. The filter inserted in the 40-mc i-f signal path is determined by the setting of IMPULSE-BANDWIDTH-MC switch S4201.

3-39. Setting the IMPULSE BANDWIDTH-MC switch to 1 inserts the 1-mc impulse bandwidth band-pass filter into the 40-mc i-f line. The response of this filter is adjusted, by means of variable capacitors C4207, C4209, to yield an impulse (-6db) bandwidth of 1 mc.

3-40. When the IMPULSE BANDWIDTH-MC switch is set to 5, the switching circuitry inserts a 5-mc impulse bandwidth filter into the 40-mc i-f line. The response of this filter is controlled, through variable capacitors C4202, C4203, and C4204, to provide a 5-mc impulse bandwidth.

3-41. Setting S4201 to WIDEBAND couples the third i-f signal directly to 40-mc i-f amplifier Q4201. The resulting signal is coupled through 40-mc i-f amplifier Q4201 to the 40-mc i-f amplifier (refer to paragraph 3-42).

3-42. 40-MC I-F AMPLIFIER. The 40-mc i-f amplifier (see figures 3-2 and 5-9) consists of a four-stage 40-mc i-f amplifier, a video detector, and two

video amplifiers. This assembly detects and amplifies the amplitude modulation content of the third i-f signal for application to the peak detector/metering amplifier, VIDEO OUTPUT connector, and AUDIO OUTPUT connector and simultaneously couples a portion of the 40-mc i-f signal to the fm/afc amplifier.

3-43. The output of the 40-mc section of the 140/40-mc band-pass filter is amplified by Q401 and Q402, the first two stages of a 40-mc i-f amplifier. The output of Q402 is transformer coupled, through the two secondary windings of T402, to both the base of Q403 and the fm/afc amplifier (refer to paragraph 3-52).

3-44. That portion of the signal coupled to Q403 is further amplified and applied to the control grid of V401, the last stage of the amplifier chain. The output of V401, taken at the plate, is coupled to first detector CR401, the phasing of this diode being such as to pass only the negative portion of the signal to the base of video amplifier Q404, an emitter follower. The output of Q404 is coupled to both the peak detector/metering amplifier (refer to paragraph 3-45) and video amplifier Q405, the latter supplying the VIDEO OUTPUT and AUDIO OUTPUT connectors when the AM FM switch is set to AM.

3-45. PEAK DETECTOR/METERING AMPLIFIER. The peak detector/metering amplifier (see figures 3-2, 3-5, and 5-10) contains the weighting circuitry and vtvm that drives the front panel Output meter to provide a visual indication of the levels of applied r-f signals. This assembly also contains a two-stage d-c amplifier that develops an agc voltage applied to the amplifiers within the 140+40-mc i-f amplifier.

3-46. The output of emitter follower Q404 (refer to paragraph 3-44) is applied through second detector CR701 to the control grid (pin 2) of difference amplifier V701. The weighting network connected between the control grid and chassis ground is determined by the setting of WEIGHTING FUNCTION switch S701. Thus, when S701 is set to AVG, the weighting network consists of R710, R732, and C704. This network has both a fast charge time (0.1 μ sec) and discharge time (0.3 μ sec) for the detected signal. These characteristics permit the output of the network to follow the modulation envelope of the detected i-f signal.

3-47. Setting the WEIGHTING FUNCTION switch to SLIDEBACK re-inserts the average weighting network into the grid circuit of V701. This position of S701 permits a d-c bucking voltage (obtained from the SLIDEBACK control in conjunction with the -12 volt supply) to be applied to first detector CR402 (refer to paragraph 3-44). The level of this bucking voltage is adjusted to that value which back-biases the detector so that no signal is passed. This point of detector is obtained by adjusting both the SLIDEBACK and AUDIO GAIN controls until the modulation content of the i-f signal, monitored through a 600-ohm headset plugged into the AUDIO OUTPUT connector, is nulled. The d-c bucking voltage necessary to null the modulation is equal to the peak value of the modulation.

3-48. When WEIGHTING FUNCTION switch S701 is in the QUASI PEAK position, the weighting network comprised of R705, R732, R736, C703, and C704 is inserted in the grid circuit of V701. This weighting network has a 50 sec charge time and a 500 millisec discharge time. The amplitude response of this network, therefore, is directly proportional to both the prf and pulse width (for a given pulse amplitude) of the applied r-f signal. The Output meter reading, for this setting of S701, will be indicative of the duty cycle of the applied r-f signal.

3-49. Setting S701 to PEAK introduces the peak weighting network (R732, R733, R734, C702, and C704) into the grid circuit. The fast charge time (0.1 μ sec) and very slow discharge time (1 second) permits this network to respond to the peak level of the applied signal.

3-50. The output of difference amplifier V701, taken at the cathodes (pins 4 and 5), simultaneously drives Output meter M1 and the d-c amplifiers developing the agc voltage (refer to paragraph 3-51).

3-51. The agc voltage used to adjust the base voltage of the amplifiers within the 140/40-mc i-f amplifier is obtained from the output of difference amplifier V701 through d-c amplifiers Q701 and Q702. This agc voltage, applied only when Scale Selector switch S3 is set to XTAL MA, 70 DB, or μV, both linearizes the gain of the i-f circuitry and extends the overall dynamics range of the Model TR to 70 db.

3-52. FM/AFC AMPLIFIER. The fm/afc amplifier (see figures 3-2 and 5-11) is employed to generate an afc error signal that, in conjunction with the reflector voltage supply and klystron first local oscillator, keeps the Model TR tuned to the frequency of the applied r-f signal. The fm/afc amplifier simultaneously recovers the intelligence of any frequency-modulated applied r-f signals. This assembly consists of a 40-mc i-f amplifier, a 40-mc limiter, a second 40-mc i-f amplifier, and a frequency discriminator followed by an afc amplifier.

3-53. The 40-mc third i-f signal from the 40-mc i-f amplifier is coupled through Q501 and applied to the base of Q502. The output of Q502, limited by diodes CR501 and CR502, is applied to the base of 40-mc i-f amplifier Q503. The output of this amplifier is coupled, through the twin secondaries of 1-f transformer T502, to a frequency discriminator network consisting of two tuned circuits, two crystal diode detectors, and two capacitors input filters.

3-54. The tuned network containing CR503 is adjusted by varying the coefficient of coupling between the

primary and appropriate secondary winding of T502, to provide a maximum output at a frequency of 36.5 mc. The tuned network containing CR504 is similarly adjusted to provide a maximum output at 43.5 mc. Proper phasing of the diode detectors, combined with the addition of their outputs, results in a frequency discriminator having a d-c output level proportional to the frequency deviation from the desired 40-mc third i-f signal, as follows:

a. When the third i-f signal applied to the fm/afc amplifier is exactly 40 mc, the outputs of each diode detector are equal in magnitude and of opposite polarity. The sum of these voltages under this ideal condition is zero, and the bias voltage appearing at the base of afc amplifier Q504 is determined solely by the voltage divider network consisting of the -12 and +6.3 volt supplies and resistors R519 and R520.

b. A third i-f signal slightly higher than 40 mc results in the output of the 43.5-mc network (CR504 and associated circuitry) having a greater magnitude than that of the 36.5-mc network. This condition results in the ideal state.

c. Conversely, a third i-f signal frequency below 40 mc would cause the output of the 36.5-mc network (CR503 and associated circuitry) to be greater than that of the 43.5-mc network. The voltage appearing at the base of Q504 would, under this condition, be more negative in the ideal state.

3-55. The frequency-dependent output voltage developed by the discriminator is coupled to afc amplifier Q504. This amplifier is in the form of a phase splitter, the output being obtained from the slider of either Afc Adj 1 potentiometer R526 or Afc Adj 2 potentiometer R527, depending on the tuning unit in use. These adjustment controls permit varying the afc error signal level to compensate for component and circuit aging.

3-56. The afc error voltage is applied to a voltage divider network located in the tuning unit. This divider consists of resistors R1511, R1513, and AFC ADJUST control R1512, the potentiometer permitting fine adjustment of the magnitude of the error voltage so as to make it compatible with the reflex klystron employed as the first local oscillator. The resulting voltage at the wiper arm of AFC ADJUST control R512 is fed back (when the AFC OFF switch is set to AFC) to the reflector voltage supply (refer to paragraph 3-75), where it resets the output level of the supply to that voltage which will maintain the klystron first local oscillator at a frequency exactly 260 mc away from the applied r-f signal.

3-57. The frequency-modulated intelligence present in the applied r-f signal is transformed, through the discriminator, into an amplitude-modulated signal. This signal is taken from the emitter of Q504 and coupled through pin H of multipin connector P503 to both the VIDEO OUTPUT connector and the audio amplifier section of the 1-kc oscillator/audio amplifier (refer to paragraph 3-63) when AM FM switch S4 is set to FM.

3-58. CRYSTAL-CONTROLLED LOCAL OSCILLATOR. The crystal-controlled local oscillator (see figures 3-2 and 5-12) generates the 120 and 140 mc signals required for mixing with the first and second i-fs, respectively, and consists of a crystal-controlled 60-mc oscillator simultaneously feeding both a frequency doubler and a frequency tripler.

3-59. The 60-mc oscillator consists of Q301, Y301, and associated circuitry interconnected to form a grounded-base crystal oscillator. The output of this circuit is coupled through buffer amplifier Q302 and applied to both frequency doubler Q303 (refer to paragraph 3-60) and frequency tripler Q304 (refer to paragraph 3-61).

3-60. Q303, operating in its non-linear region, both amplifies and generates harmonics of the applied 60-mc signal. The output of this stage is coupled through a band-pass filter tuned to 120 mc. This filter attenuates the 60-mc fundamental and all harmonics but the 120-mc component. The output of the filter is amplified to optimum mixing level by 120-mc power amplifier Q305 and applied to the second crystal mixer within the 260/140-mc low-noise preamplifier.

3-61. Frequency tripler Q304 operates in a manner similar to that of frequency doubler Q303. The output of the tripler stage is coupled through a band-pass filter tuned to 180 mc and amplified to optimum mixing level by Q306 prior to application to the third mixer within the 140/40-mc i-f amplifier

3-62. To facilitate the detection of unmodulated and/or low-level applied r-f signals, the 120-mc output of the crystal-controlled local oscillator can be amplitude-modulated by a 1-kc audio signal obtained from the oscillator section of the 1-kc oscillator/audio amplifier (refer to paragraph 3-63. This aural tuning aid feature is obtained by superimposing the 1-kc tone upon the 120-mc signal applied to the base of Q305.

3-63. 1-KC OSCILLATOR/AUDIO AMPLIFIER. The 1-kc oscillator-audio amplifier (see figures 3-2 and 5-13) contains both a 1,000-cps aural tuning aid oscillator and an audio amplifier. The former is employed to generate a 1-kc aural tone that facilitates the detection of low-level and/or unmodulated applied r-f signals. The latter, in conjunction with the AUDIO GAIN control, amplifies the audio modulator content of the detected third i-f signal and permits monitoring of the modulation through the use of an external 600-ohm headset plugged into the AUDIO OUTPUT connector.

3-64. The 1-kc oscillator consists of Hartley-type oscillator Q604. This circuit is operative only when

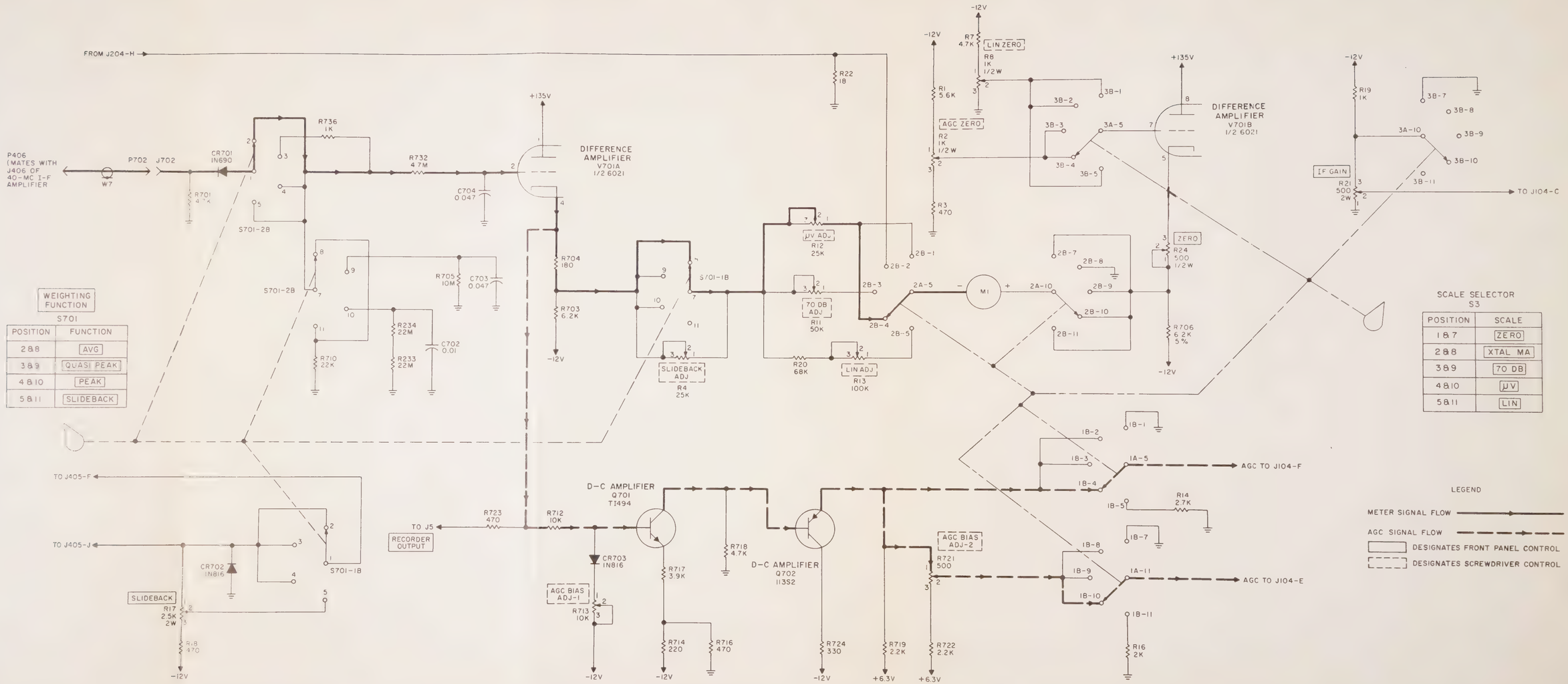


Figure 3-5. Peak Detector/Metering Amplifier and Output Meter Circuitry, Composite Simplified Schematic Diagram

AURAL AID OFF switch S6 is set to AURAL AID. The positive feedback required to sustain oscillators is obtained between collector and emitter. The 1-kc aural tone is coupled, through pin C of multipin connector P601, to the base of the 120-mc power amplifier located within the crystal-controlled local oscillator.

3-65. Any modulation of the 40-mc third i-f signal (obtained from either the 40-mc i-f amplifier or the fm/afc amplifier) is coupled, through AM FM switch S4 to VIDEO OUTPUT connector J3. A portion of this modulation, determined by the setting of AUDIO GAIN control R23, is coupled to audio amplifier Q605, the first stage of a three-stage audio amplifier. After further amplification by Q601 and Q602, the power level of the modulation is boosted by audio power amplifier Q603 and transformer coupled to AUDIO OUTPUT connector J4, where it can be monitored through a 600-ohm headset.

3-66. POWER DISTRIBUTION. (See figures 3-6, 5-15, and 5-17).

3-67. The voltages required to energize the various circuits of the Model TR are derived from a self-contained power supply capable of functioning from either a 12 volt d-c source or a 115/230 volt, 50 to 1,000 cps a-c line. This power supply, located in the lower section of the basic unit, is described in paragraphs 3-68 through 3-86.

3-68. LINE POWER SWITCHING CIRCUITRY. The facility of operating from either an a-c or d-c power source is accomplished by means of Ac/Dc switch S8, Ac/Dc relay K2, and 115/230V switch S9, as illustrated in figure 3-6.

3-69. When the Model TR is operated from a 12 volt (battery) source, line power is coupled through S8 and K2 (see figure 3-6). Polarity protection diode CR2, located in the actuating coil circuit of Ac/Dc relay K2, allows the transfer of d-c line power only when the source voltage is -12 volts with respect to equipment ground. This protective device prevents possible destruction of circuit elements should the battery be connected in the opposite polarity. The applied d-c power is then applied to three regulator circuits: one in the -6.3 volt supply (refer to paragraph 3-71), another driving the beam voltage supply (refer to paragraph 3-72); and the third driving the reflector voltage, +175 volt, +135 volt, +6.3 volt, -12 volt, -24 volt, and klystron grid bias supplies (refer to paragraph 3-75 through 3-84).

3-70. When the Model TR is operated from an a-c power line, power is coupled through S8 and S9 (see figure 3-6) and applied to the primary windings of step-down power transformer T801. The secondary output is converted to a d-c level of approximately -12 volts by full-wave bridge rectifier CR801 through CR804. The resulting -12 volt power is applied to the remainder of the power supply (refer to paragraphs 3-71, 3-72, and 3-75).

3-71. -6.3 VOLT SUPPLY. The -6.3 volt supply (see figures 3-6 and 5-15) is a series regulator operating from a -12 volt source. Pass transistor Q802 is an emitter follower whose input is the voltage across voltage reference diode CR851. Resistor R854 provides both the base drive current for Q802 and the breakdown current for CR851. Variations in the unregulated -12 volt input voltage are held constant at the base of Q802 due to the breakdown characteristics of CR851. The emitter of Q802 will assume the same potential as the base with a consequent current gain, and the output of the supply is maintained constant at -6.3 volts.

3-72. BEAM VOLTAGE SUPPLY. The beam voltage supply (see figures 3-6 and 5-15) is a conventional degenerative voltage regulator driving an inverter. The output of the inverter, determined by the secondary taps of step-up power transformer T802 and the interlock circuitry of the tuning unit in use, is applied to voltage doubler CR818, CR819, and CR821 through CR824. The doubler output is filtered and applied to the klystron first local oscillator through delay relay K802 (refer to paragraph 3-86).

3-73. The regulator section of the beam voltage supply consists of pass transistors Q814, Q816, and Q817, emitter followers Q821 and Q822, control amplifier Q823, voltage reference CR817, starting diode CR846, compensating diode CR820, and Beam Voltage Adj control R841. The output level of this regulator, determined by the setting of Beam Voltage Adj control R841 and a fed-back portion of the beam voltage supply output, adjusts itself to maintain the voltage applied to the inverter (refer to paragraph 3-74) at that value which develops the required beam voltage.

3-74. The output of the beam supply regulator furnishes operating power to the beam supply inverter, a push-pull, square-wave oscillator consisting of Q818, Q819, and T802. Oscillation (between 1,000 and 3,000 cps, depending on applied voltage) is maintained by positive collector-to-base feedback. The square-wave developed by the inverter is employed to drive the inverter of the reflector and low voltage supplies (refer to paragraph 3-75).

3-75. REFLECTOR VOLTAGE SUPPLY. The reflector voltage supply (see figures 3-6 and 5-15) is a conventional degenerative voltage regulator applying power to a driven inverter. The output of this driven inverter, taken at one set of secondary taps of T803, (terminals 6 and 7), is applied to the voltage doubler consisting of diodes CR809, CR811, CR812, and CR813. The filtered output of the doubler (-600 volts) is superimposed upon the beam voltage supply and the two combine to form the reflector voltage supply.

3-76. The regulator section that supplies operating power to the driven inverter consists of pass transistors Q806 and Q807, emitter followers Q808 and Q809, control amplifier Q811, starting diode CR815, compensating diode CR810, voltage reference CR806, and Reflector Voltage Adj control R822. The output level of this regulator, determined by the setting of the Reflector Voltage Adj control R822, a fed-back portion of the reflector voltage supply output, and the output of afc amplifier Q824 (refer to paragraph 3-77) adjusts itself so that the voltage applied to the driven inverter is of the proper magnitude to obtain the required reflector voltage.

3-77. The afc error signal developed within the fm/afc amplifier (refer to paragraph 3-52) is always coupled to the base of afc amplifier Q824, an emitter follower. The output of the afc amplifier, coupled to the reflector supply voltage regulator only when AFC OFF switch S5 is set to AFC, permits the output of the reflector supply to reset itself to that voltage which will maintain the klystron first local oscillator at a frequency exactly 260 mc away from the applied r-f signal.

3-78. +175 VOLT SUPPLY. The +175 volt supply (see figures 3-6 and 5-15) is obtained from the secondary taps (terminals 4 and 5) of transformer T803 and half-wave rectifier CR833. This +175 volt unregulated supply, in addition to providing operating power for the grounded-grid stages of the 260/140-mc low-noise preamplifier also furnishes power to both the +135 volt (refer to paragraph 3-79) and +6.3 volt (refer to paragraph 3-80) supplies.

3-79. +135 VOLT SUPPLY. The +135 volt supply (see figures 3-6 and 5-15) consists of the +175 volt unregulated supply, dropping resistor R844, and series-connected voltage regulators CR838 and CR839. The regulated output of this supply is employed to drive the +6.3 volt supply (refer to paragraph 3-80).

3-80. +6.3 VOLT SUPPLY. The +135 volt regulated supply, in conjunction with dropping resistor R861 and voltage regulator CR847 (see figures 3-6 and 5-15) constitutes the +6.3 volt regulated power supply.

3-81. +25 VOLT KLYSTRON BIAS SUPPLY. The voltage required for biasing the control grid of the klystron first local oscillator is obtained through a half-wave rectifier and voltage regulator (CR827 and CR831, respectively) connected to terminals 8 and 9 of T803 (see figures 3-6 and 5-15). The negative side of this regulated supply is tied to the beam voltage supply.

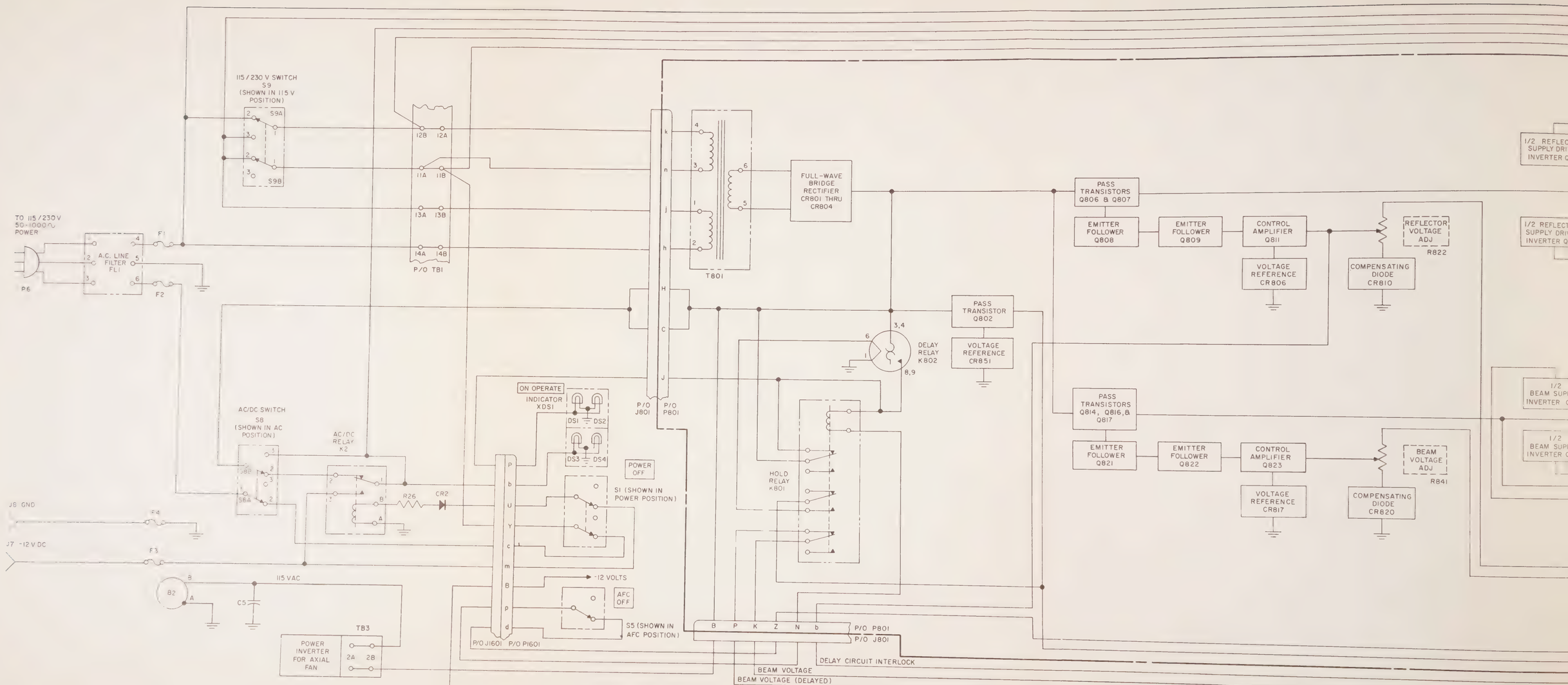
3-82. -24 VOLT SUPPLY. The -24 volt regulated supply (see figures 3-6 and 5-15) consists of a voltage doubler (CR842 and CR843) driven by the square-wave signal appearing at the collector of Q812. The output of the doubler is coupled through R848 to voltage regulator CR844, yielding the regulated -24 volt output.

3-83. 6.3 VOLT KLYSTRON FILAMENT SUPPLY. The 6.3 volts required for the filament of the reflex klystron is obtained by coupling the square-wave output at the collectors of Q818 and Q819 to isolation transformer T804 (see figures 3-6 and 5-15). The rectified output of T804 is filtered and coupled to the reflex klystron. This supply, like the klystron bias supply, is also tied to the output of the beam voltage supply.

3-84. -12 VOLT SUPPLY. The -12 volt supply (see figures 3-6 and 5-15) is obtained by rectifying the square-wave signal appearing at the collectors of Q818 and Q819. The regulated output of this supply is taken across CR841.

3-85. POWER INVERTER FOR AXIAL FAN. The 115 volts necessary to operate axial blower B2 is obtained from a d-c to a-c inverter (see figures 3-6, 5-16, and 5-17). The inverter, consisting of Q1, Q2, and T1, operates from an unregulated -12 volt line and supplies a trapezoided output of approximately 250 volts peak-to-peak at 60 cps.

3-86. TIME DELAY CIRCUIT. Time delay relay K802 and hold relay K801 (see figures 3-6 and 5-15) delays the application of both beam and reflector voltage to the klystron first local oscillator until the filament of this tube has been on for approximately 75 seconds. Delaying the application of these potentials prevents possible destruction of the cathode structure when in an unheated state.


115/230 V SWITCH S9 (SHOWN IN 115 V POSITION)
S9A
S9B
12B 12A
11A 11B
13A 13B
14A 14B
P/O TB1
TO 115/230 V 50-1000 ~ POWER
P6
A.C. LINE FILTER FL1
F1
F2
T801
FULL-WAVE BRIDGE RECTIFIER CR801 THRU CR804
PASS TRANSISTORS Q806 & Q807
EMITTER FOLLOWER Q808
EMITTER FOLLOWER Q809
CONTROL AMPLIFIER Q811
VOLTAGE REFERENCE CR806
REFLECTOR VOLTAGE ADJ
R822
COMPENSATING DIODE CR810
1/2 REFLECTOR SUPPLY DRIVER INVERTER Q
PASS TRANSISTOR Q802
VOLTAGE REFERENCE CR851
DELAY RELAY K802
ON OPERATE INDICATOR XDS1
DS1 DS2 DS3 DS4
P/O J801
P/O P801
AC/DC SWITCH S8 (SHOWN IN AC POSITION)
S8A S8B
AC/DC RELAY K2
R26
CR2
POWER OFF
S1 (SHOWN IN POWER POSITION)
HOLD RELAY K801
PASS TRANSISTORS Q814, Q816, & Q817
EMITTER FOLLOWER Q821
EMITTER FOLLOWER Q822
CONTROL AMPLIFIER Q823
VOLTAGE REFERENCE CR817
BEAM VOLTAGE ADJ
R841
COMPENSATING DIODE CR820
1/2 BEAM SUPPLY INVERTER Q
J8 GND
F4
J7 -12 V DC
F3
B2
115 VAC
C5
-12 VOLTS
AFC OFF
S5 (SHOWN IN AFC POSITION)
TB3
POWER INVERTER FOR AXIAL FAN
2A 2B
P/O J1601
P/O P1601
B P K Z N b
P/O P801
P/O J801
DELAY CIRCUIT INTERLOCK
BEAM VOLTAGE
BEAM VOLTAGE (DELAYED)

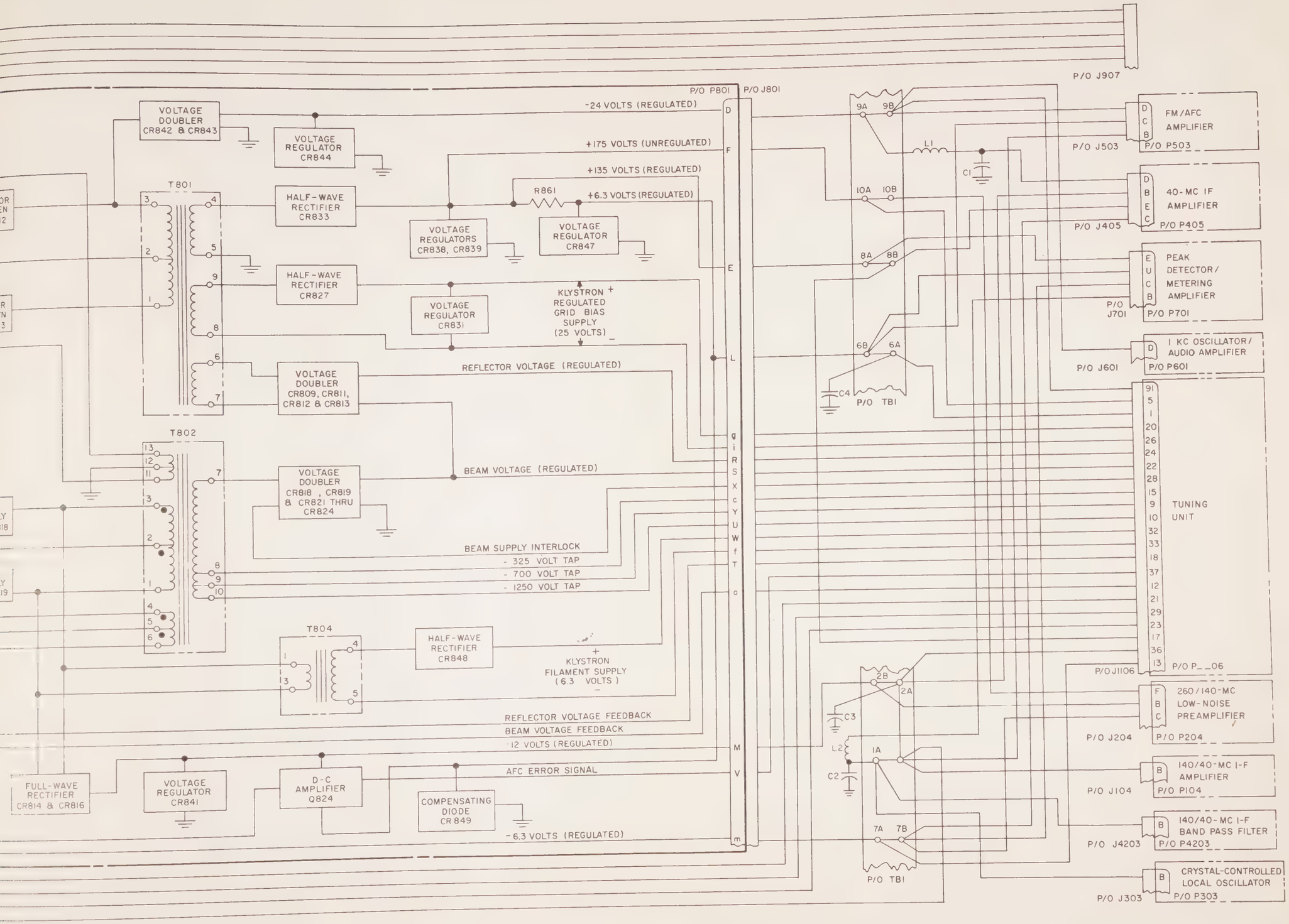


Figure 3-6. Power Distribution Diagram

SECTION IV

MAINTENANCE

4-1. GENERAL.

4-2. This section contains maintenance and alignment procedures for the Model TR Microwave Receiver system. Included are a list of required test equipment, systematic troubleshooting procedures for localizing the source of system malfunction to an individual subassembly or circuit, and alignment procedures necessary to restore the Model TR to original operating condition after the required repairs have been effected.

4-3. TEST EQUIPMENT REQUIRED.

4-4. The test equipment required for the maintenance and alignment of the Model TR system is listed in table 4-1.

4-5. PRELIMINARY INSPECTION.

4-6. Preliminary inspection is a series of visual and aural checks performed on the Model TR system while it is in an unenergized state in an effort to correct conditions which might eventually cause system failure.

4-7. REMOVAL OF MODEL TR FROM DUST COVER. To remove the Model TR from its dust cover, proceed as directed in the following steps.

WARNING

OPERATION OF THE MODEL TR INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. BE SURE TO REMOVE OPERATING POWER FROM THE BASIC UNIT BEFORE STARTING THE PRELIMINARY INSPECTION PROCEDURE.

a. Turn each of the three captive-lock fasteners located at the rear of the dust cover one-quarter turn counterclockwise with a screwdriver.

b. Loosen the three clasps that secure the front panel casting to the dust cover. Carefully remove the casting.

WARNING

THE MODEL TR (WITH A PLUG-IN TUNING UNIT INSTALLED) WEIGHS APPROXIMATELY 95 POUNDS. TWO PEOPLE SHOULD BE EMPLOYED AT ALL TIMES WHEN LIFTING, TRANSPORTING, OR PACKING THE EQUIPMENT.

c. With two men working on the Model TR (one on each side of the equipment), grasp the two front panel handles and carefully slide the Model TR from its dust cover.

4-8. REMOVAL OF TUNING UNIT FROM BASIC UNIT. To remove a plug-in tuning unit from the basic unit, proceed as directed in the following steps.

a. Disconnect r-f cable W31 from the INPUT connector of the tuning unit.

b. Turn each of the four tuning unit captive-lock fasteners (one located near each corner of the tuning unit front panel) one-quarter turn counterclockwise with a screwdriver.

c. Grasp the tuning unit front panel handle and carefully slide the tuning unit from the basic unit.

4-9. Conditions which will cause system malfunction are listed in table 4-2. Should any listed defect be found, perform the stated remedy.

4-10. MINIMUM PERFORMANCE STANDARDS.

4-11. The minimum performance standards listed in table 4-4 are an aid to determine whether the Model TR is operating within the specifications stated in paragraph 1-21. Failure of the Model TR to provide the designated "normal indication" signifies that the equipment is not operating properly and reference should be made to the applicable troubleshooting, repair, replacement, and/or alignment paragraphs to return the equipment to proper operating condition. Set the front panel operating controls as indicated in table 4-3 prior to performing the minimum performance standards check.

TABLE 4-1. TEST EQUIPMENT REQUIRED

Equipment Model and Manufacturer	Application
Polarad Models MSG-1R, MSG-2R, MSG-34, and 1709 Microwave Signal Generators	Checking and aligning r-f circuitry
FXR Models H601B, C601B, and X601B Waveguide-to-Coax Adapters (2 of each)	Frequency calibration
PRD Model 587-A Frequency Meter	Frequency calibration
FXR Models N410A, H410A, C410A, and X410A Frequency Meters	Frequency calibration
Narda Model 440 Power Meter	Power Calibration
Narda Model 561NF Mount with Model N335 Thermistor	Power calibration
Measurements Model 80 Standard Signal Generator	Checking and aligning i-f circuitry
Tektronix Model 531A Oscilloscope with Type H Preamplifier	Observing waveforms
Dumont Model 404 Pulse Generator	Checking i-f circuitry
Measurements Model 111-B Crystal Calibrator	Frequency calibration
Telex Model MR-6 Headset	Frequency calibration
Telonic Model XD-3 Detector	Checking and aligning i-f circuitry
Triplett Model 630-A Multimeter	Checking power supply voltages
Fluke Model 801 Differential Voltmeter with Model 80B5 Voltbox	Checking and setting beam and reflector supply voltages
Telonic Models SD-2 and H-3 Sweep Generators	Aligning i-f circuitry
Simpson Model 373 Milliammeter	Checking i-f circuitry
Kay Model 20-0 Attenuator	Aligning i-f circuitry
Daven Model 641-50 Attenuator	Aligning i-f circuitry
Narda Model 441B VSWR Amplifier	Aligning i-f circuitry
Marconi Model TF1041B VTVM	Checking and aligning i-f circuitry
Power Designs Model 3240 Power Supply	Checking and aligning i-f circuitry
Sage Model 1021H Crystal Holder	Aligning r-f circuitry
Polarad Model MK-1 Klystron Mode Alignment Modulator	Aligning r-f circuitry
General Radio Type 1302-A Oscillator	Checking audio amplifier
Baird Atomic Model KT-1 Beta Tester	Checking transistors
Powerstat Type 2PF236 Autotransformer	Setting beam and reflector voltages

TABLE 4-2. PRELIMINARY INSPECTION CHECK POINTS

What to Inspect	Defects to Look For	Remedies	Precautions
Cable assemblies (including power, r-f, i-f, and video cables)	Kinks, cuts, deterioration, or fraying of insulation	Replace defective cable assembly	
	Loose connectors	Resolder connectors or replace cable assembly	
	Dirt, oil, grease, and corrosion	Clean with a cloth moistened with cleaning solvent	
Harnessed cable assemblies	Loose connectors	Resolder connector	
	Deteriorated and/or frayed leads	Replace lead and relace cable	
Knobs, screws, connectors, and handles	Looseness	Tighten	Tighten carefully. Screws tightened beyond the pressure for which they were designed can be damaged or broken.
Front panel switches	Inability to change position	Replace and rewire switch	
	Looseness	Tighten mounting hardware	
	Bent or broken contacts	Straighten with tweezer or replace switch	
Fuses	Dirt on fuse clips	Clean with a cloth moistened with cleaning solvent	
Frame assemblies and subassemblies	Dirt and rust	Remove with a brush or low-pressure air	
	Oil and grease	Remove with a cloth moistened with cleaning solvent	
Mounting screws and clamps	Looseness	Tighten	Do NOT adjust shafts of screwdriver-adjusted potentiometers
Wiring	Loose wires	Resolder	
	Frayed, worn, or missing insulation	Replace wire	
Solder joints	Corroded joints	Clean and resolder	
Terminal board assemblies	Loose mounting	Tighten mounting hardware	

(Cont'd)

TABLE 4-2. PRELIMINARY INSPECTION CHECK POINTS (Cont'd)

What to Inspect	Defects to Look For	Remedies	Precautions
Resistors	Cracks, chips, discoloration, blistering, and/or other signs of overheating	Replace with resistor of proper value, tolerance, and power rating (see schematic diagrams)	Overheated components are a sign of equipment malfunction. Refer to troubleshooting tables to localize malfunction.
Capacitors	Leaks, bulges, and/or other signs of deterioration	Replace with capacitor of proper value, tolerance, and voltage rating	See above
Front panel meter	Bent pointer	Replace meter	
	Cracked or broken meter cover	Replace cover	
Transistors	Poor seating	Properly seat transistors	Do not bend or overstress transistor leads.
Vacuum tubes (except for reflex klystrons)	Poor seating	Seat tubes firmly into mountings	Never work on tubes immediately after shutting off power. DO NOT CHECK REFLEX KLYSTRONS.
Tube shields (except for reflex klystron protective shield)	Poor seating	Press shields into position	
Tube and transistor sockets	Cracked or chipped sockets	Replace	
	Looseness	Tighten mounting hardware	
Frequency indicator window	Cracked or broken	Replace	
Precision mechanical drive system	Catching or jamming when Tuning control is rotated	Remove dust, dirt, and any foreign matter	**CAUTION** DO NOT ATTEMPT TO MOVE THE PRECISION MECHANICAL DRIVE SYSTEM BY ANY MEANS OTHER THAN THE TUNING CONTROL. DO NOT INTERFERE IN ANY WAY WITH THE OPERATION OF THE GEARS. NEVER USE FORCE
	Broken gears	Replace	

TABLE 4-3. PRELIMINARY CONTROL SETTINGS, MINIMUM PERFORMANCE STANDARDS

Front Panel Control	Setting
IMPULSE BANDWIDTH-MC switch	1
WEIGHTING FUNCTION switch	AVG
Scale Selector switch	ZERO
AM FM switch	AM
AURAL AID OFF switch	OFF
AFC OFF switch	OFF
AUDIO GAIN control	Fully counterclockwise
SLIDEBACK control	Fully counterclockwise
IF GAIN control	Mid-position
POWER OFF switch	OFF

4-12. POWER SUPPLY CHECK.

4-13. Improper operation of the Model TR can be caused by a malfunction within the power supplies. To ascertain that the supplies are functioning properly, proceed as outlined in the following steps.

a. With the Model TR disconnected from operating power, remove the tuning unit from the basic unit. (Refer to paragraph 4-8.)

b. Connect patch cable W35 between the basic unit and the tuning unit.

c. Tape a 9" x 11" sheet of cardboard (with a small cutout for the patch cable) over the basic unit front panel opening created by the removal of the tuning unit. This is to insure proper air flow within the equipment.

Note

The basic unit is to remain within the dust cover.

d. Connect a voltmeter between the points indicated in table 1-5.

WARNING

VOLTAGES DANGEROUS TO LIFE EXIST AT THE TERMINALS OF THE TUNING UNIT MULTIPLE-PIN CONNECTOR. BE SURE TO CONNECT AND DISCONNECT VOLTMETER PROBES ONLY AFTER REMOVING OPERATING POWER FROM THE MODEL TR.

CAUTION

BE CAREFUL TO AVOID SHORTING OF ADJACENT CONNECTOR PINS WITH THE VOLTMETER PROBES.

4-14. POWER SUPPLIES, TROUBLESHOOTING. To troubleshoot the power supplies, proceed as directed in the following steps:

a. With operating power removed from the Model TR, withdraw the basic unit from the dust cover and remove the turing unit from the basic unit (refer to paragraphs 4-7 and 4-8, respectively).

b. Remove the four screws that secure the power supply to the basic unit frame.

c. With the tuning unit connected to the basic unit via patch cable W35, energize the Model TR.

d. Defects within the power supply may be localized by measuring the voltages at the pins of each transistor. (Refer to figure 5-15 and table 5-9.)

e. De-energize the Model TR and effect the necessary repairs and/or replacements.

f. Replace the power supplies into the basic unit and secure the former to the basic unit frame. Refer to paragraph 4-15 for the alignment procedure to be employed after the beam and/or reflector supplies have been repaired.

TABLE 4-4. MINIMUM PERFORMANCE STANDARDS

Step	Purpose	Procedure	Normal Indication	Abnormal Indication Reference
1	To evaluate operating power conditions.	Apply operating power to the Model TR as described in steps a through i of paragraph 2-8.	ON indicator illuminates (red) when POWER OFF switch is set to POWER.	Check indicator for burned-out bulbs. Replace bulbs, if necessary. Refer to paragraph 4-12.
			OPERATE indicator illuminates (white) approximately 75 seconds after POWER OFF switch is set to POWER.	Same as above.
2	To evaluate zero-set operation.	Allow the Model TR to warm up for at least 15 minutes. Adjust the Zero control, if necessary, to obtain an Output meter indication of CAL.	Output meter indicates CAL.	I-f circuitry defective. Refer to paragraph 4-18.
3	To evaluate operation of IF GAIN control (noise voltage variation).	With no signal applied to the Model TR, set the Scale Selector switch to LIN and rotate the IF GAIN control fully clockwise. Note the Output meter indication.	Output meter indicates 8 (minimum) on the LIN scale.	I-f circuitry defective. Refer to paragraph 4-18.
4	To evaluate frequency range, frequency accuracy, and sensitivity of tuning units.	Adjust the IF GAIN control to obtain an Output meter indication of 3 on the LIN scale. Connect a microwave signal generator to a power meter (as illustrated in figure 4-1a). Adjust the signal generator for a 0 dbm (one milliwatt) cw output (as determined by the power meter) at a frequency corresponding to the low end of the band of the tuning unit under test. Note the db error of the signal generator. Determine (by means of the frequency meter) and note the frequency of the signal generator output. Reduce the signal generator output level to approximately -80 dbm and connect the equipment as illustrated in figure 4-1b. Tune the Model TR to obtain an Output meter indication of maximum deflection.	The tuning unit under test shall be continuously tunable over the band specified below: Tuning Unit — Frequency Range Model T-RL 0.95 to 2.04 gc Model T-RS 1.90 to 4.34 gc Model T-RM 4.20 to 7.74 gc Model T-RX 7.30 to 11.26 gc	Tuning unit and/or basic unit defective. Refer to paragraph 4-16.
			Frequency accuracy, as determined by the equation $\%\,\text{Accuracy} = \frac{f_{fm} - f_{indicator}}{f_{fm}} \times 100$ (where f_{fm} = frequency meter reading, in GC, and	Tuning unit improperly tracked. Refer to paragraph 4-44.

(Cont'd)

TABLE 4-4. MINIMUM PERFORMANCE STANDARDS (Cont'd)

Step	Purpose	Procedure	Normal Indication	Abnormal Indication Reference
4 (Cont'd)		Note It may be necessary to adjust the IF GAIN control to maintain an on-scale indication on the Output meter.	$f_{indicator}$ = Frequency indicator reading, in gc) shall be equal to or better than ±1%.	
		Note the reading of the Frequency indicator. Adjust the signal generator for minimum output power (less than -120 dbm) and re-adjust the IF GAIN control to obtain an Output meter indication of 2 on the LIN scale. Carefully increase the signal generator output level to obtain an Output meter indication of 2.8 on the LIN scale. Note the reading (in-dbm) of the signal generator output attenuator dial. This reading (± the signal generator db error) is the sensitivity of the Model TR at the test frequency. Repeat the above procedure (in 200 Mc increments) throughout the remainder of the band of the tuning unit under test.	The equipment sensitivity (throughout the band of the tuning unit under test) shall be equal to or better than the values specified below: Tuning Unit — Sensitivity Model T-RL — -90 dbm Model T-RS — -90 dbm Model T-RM — -88 dbm Model T-RX — -88 dbm	Tuning unit and/or basic unit defective. Refer to paragraph 4-16.
5	To evaluate Output meter scale tracking.	With the equipment connected as illustrated in figure 4-1a, set the Scale Selector switch to 70 DB. Tune the signal generator to a frequency corresponding to the mid-band frequency of the tuning unit under test and calibrate the signal generator power level. Adjust the signal generator for a cw output of approximately -40 dbm and connect the equipment as illustrated in figure 4-1b. Set the IF GAIN control to mid-position and slowly rotate the Tuning control	The Output meter DB scale tracks with an accuracy of ±2 db (or better) over a 70-db dynamic range.	Output meter improperly tracked. Refer to paragraph 4-33.

(Cont'd)

TABLE 4-4. MINIMUM PERFORMANCE STANDARDS (Cont'd)

Step	Purpose	Procedure	Normal Indication	Abnormal Indication Reference
5 (Cont'd)		until the Output meter indicates a maximum. Adjust the signal generator for minimum output power and adjust the IF GAIN control to obtain an Output meter indication of CAL. Increase the signal generator output level to obtain an Output meter indication slightly greater than full scale and then carefully reduce to obtain an indication of exactly 70 on the DB scale. Note the signal generator output level (in-dbm). Carefully reduce the strength of the applied signal, in 10-db increments, a total of 70 db. At each 10-db point note the Output meter indication on the DB scale and the signal generator output level.		
		Adjust the signal generator for a 1,000 microvolt cw output and set the Scale Selector switch to μV. Adjust the IF GAIN control to obtain an Output meter indication of exactly 60 on the 1 MC range of the DB ABOVE 1 μV scale (corresponding to 1000 on the μV RF scale). Carefully reduce the strength of the applied signal, in 5-db increments, a total of 50 db. At each 5-db point note both the Output meter indication (on the 1 MC range of the DB above 1 μV scale) and the signal generator output level.	The Output meter μV RF scale (and DB ABOVE 1 μV scale) tracks with an accuracy of ± 1 db (or better).	Same as above.
6 (Cont'd)	To evaluate rejection of image and other spurious responses.	With the equipment connected as illustrated in figure 4-1a, tune the signal generator to the frequency corresponding to the low end of the band of the tuning unit under test. Calibrate the signal generator power level and adjust for a cw output of approximately -40 dbm. Set the Scale Selector switch to 70 DB, the IF GAIN control to	Output meter indication for all responses other than fundamental shall be less than 10 on the DB scale.	Preselector improperly tracked. Refer to paragraph 4-48.

TABLE 4-4. MINIMUM PERFORMANCE STANDARDS (Cont'd)

Step	Purpose	Procedure	Normal Indication	Abnormal Indication Reference
6 (Cont'd)		mid-position, and connect the equipment as illustrated in figure 4-1b. Slowly rotate the Tuning control until the Output meter indicates a maximum. Adjust the signal generator for minimum output power and adjust the IF GAIN control to obtain an Output meter indication of CAL. Increase the signal strength to obtain an Output meter indication of 70 on the DB scale. Slowly rotate the Tuning control throughout the band and note all Output meter indications. Repeat the above procedure (in 200-mc increments) throughout the remainder of the band of the tuning unit under test.		
7	To evaluate impulse bandwidths.	Set the Scale Selector switch to μV. Disconnect i-f cable W13 from IF input connector J1. Adjust the IF GAIN control to obtain an Output meter indication of CAL. Tune a standard signal generator for a cw output at 140 mc (by means of a crystal calibrator and headset) and adjust for minimum output power. Connect the equipment as illustrated in figure 4-2a and increase the signal generator output level to obtain an Output meter indication of exactly 1000 on the μV RF scale. Detune the signal generator (while maintaining constant output power) either side of 140 mc until the Output meter indicates 450 on the μV RF scale. Note the frequency of the signal generator at these points.	The impulse bandwidth of the Model TR (with the IMPULSE BANDWIDTH -MC switch set to 1) shall be 1 mc (± 10%).	I-f circuitry improperly tuned Refer to paragraph 4-18.

(Cont'd)

TABLE 4-4. MINIMUM PERFORMANCE STANDARDS (Cont'd)

Step	Purpose	Procedure	Normal Indication	Abnormal Indication Reference
7 (Cont'd)		Repeat the above procedure with the IMPULSE BANDWIDTH-MC switch set to 5	The impulse bandwidth of the Model TR (with the IMPULSE BANDWIDTH-MC switch set to 5) shall be 5 mc (±10%).	Same as above.
		Repeat the above procedure with the IMPULSE BANDWIDTH-MC switch set to WIDEBAND.	The impulse bandwidth of the Model TR (with the IMPULSE BANDWIDTH-MC switch set to WIDEBAND) shall be at least 8 mc.	Same as above.
8	To evaluate video bandwidth.	Connect the standard signal generator (tuned to 140 Mc and set for a pulse modulated output of 1,000 pps, a pulse width of 10 microseconds, and a peak power level of 0 dbm) as illustrated in figure 4-2b. Note the rise-time of the displayed pulsed signal. Set the Scale Selector switch to LIN, the WEIGHTING FUNCTION switch to PEAK, and the IMPULSE BANDWIDTH-MC switch to 5. Set the IF GAIN control to mid-position and reduce the signal generator output level to approximately -50 dbm. Connect the equipment as illustrated in figure 4-2c. Note the rise-time of the displayed pulsed signal.	The rise time of the video circuitry, as determined by the equation $T = \sqrt{(t_2)^2 - (t_1)^2}$ (where T is the video circuitry rise time, t_2, is the rise time of the pulsed signal appearing at the VIDEO OUTPUT connector, and t_1, is the rise time of the signal generator pulsed output) shall be equal to or less than 0.1 microsecond.	Same as above.
9	To evaluate video output.	With the equipment still connected as illustrated in figure 4-2c, increase the signal generator output level to obtain a full-scale Output meter indication. Note the amplitude of the displayed pulsed signal.	Video output amplitude is at least 0.2 volts.	Same as above.

(Cont'd)

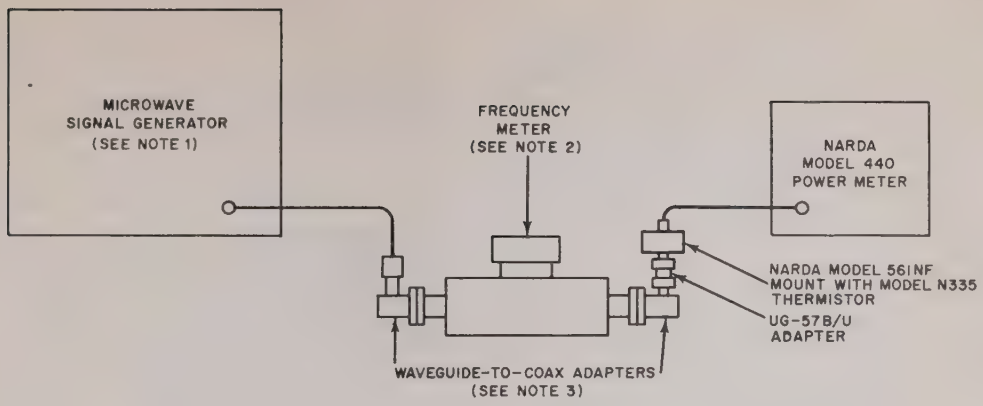
TABLE 4-4. MINIMUM PERFORMANCE STANDARDS (Cont'd)

Step	Purpose	Procedure	Normal Indication	Abnormal Indication Reference
10	To evaluate recorder output.	Without adjustment of the Model TR or microwave signal generator, remove the oscilloscope from the setup of figure 4-2c and couple a vtvm (across a 100K load) to the RECORDER OUTPUT connector. Reduce the signal generator output level to minimum and adjust the IF GAIN control to obtain an Output meter indication of CAL. Note the vtvm reading. Increase the signal generator output level to obtain a full-scale indication on the Output meter. Note the vtvm reading. Repeat the above procedure with the Scale Selector set, in turn, to μV and 70 DB.	The voltage swing at the RECORDER OUTPUT connector shall be equal to or greater than the values specified below: Scale Selector switch setting / RECORDER OUTPUT voltage swing LIN — 10 volts μV — 2.5 volts 70 DB — 3 volts	Same as above.
11	To evaluate audio output.	With the standard signal generator still tuned to 140 mc, adjust for a 1,000-cps, 30% amplitude-modulated output. Set the Scale Selector switch to μV and adjust the signal generator for minimum output level. Connect the equipment as illustrated in figure 4-2a and connect an oscilloscope (across a 600 ohm load) to the AUDIO OUTPUT connector. Adjust the IF GAIN control to obtain an Output meter indication of CAL. Increase the signal generator output level to obtain an Output meter indication of 60 on the 1 MC range of the DB ABOVE 1 μV scale. Rotate the AUDIO GAIN control fully clockwise and note the oscilloscope display.	Audio output shall be a minimum of 35 volts peak-to-peak (250 mw into 600 ohms).	Audio amplifier defective. Refer to paragraph 4-34.

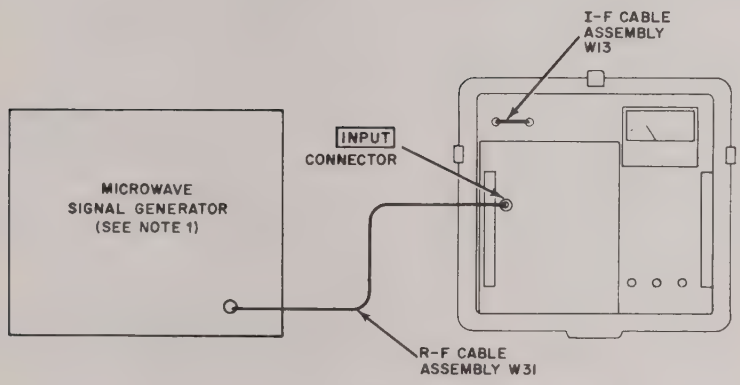
TABLE 4-5. POWER SUPPLY CHECK PROCEDURE

Test Instrument	Connect Positive Probe to	Connect Common Probe To	Normal Reading	If Reading Is Abnormal
Differential Voltmeter and Voltbox	Tuning unit ground	Pin 23 of tuning unit connector	-325v (±1%)* -1250v (±1%)**	Refer to paragraph 4-14
Differential Voltmeter and Voltbox	Tuning unit ground	Pin 24 of tuning unit connector	-925v (±1%)* -1850v (±1%)**	Refer to paragraph 4-14.
Multimeter	Pin 20 of tuning unit connector	Pin 26 of tuning unit connector	+25v (±10%)	Refer to paragraph 4-14.
Multimeter	Pin 32 of tuning unit connector	Pin 33 of tuning unit connector	+6.3v (±10%)	Refer to paragraph 4-14.
Multimeter	Tuning unit ground	Pin 36 of tuning unit connector	-12v (±10%)	Refer to paragraph 4-14.
Multimeter	Tuning unit ground	Pin 11 of tuning unit connector	-24v (±10%)	Refer to paragraph 4-14.
Multimeter	Tuning unit ground	Pin 13 of tuning unit connector	-6.3v (±10%)	Refer to paragraph 4-14.
Multimeter	Pin 1 of tuning unit connector	Tuning unit ground	+6.3v (±10%)	Refer to paragraph 4-14.
Multimeter	Pin 17 of tuning unit connector	Tuning unit ground	+135v (±10%)	Refer to paragraph 4-14.
Multimeter	Pin 5 of tuning unit connector	Tuning unit ground	+175v (±10%)	Refer to paragraph 4-14.

*Model T-RL or T-RS Tuning Unit connected to basic unit.
**Model T-RM or T-RX Tuning Unit connected to basic unit.



(a)



(b)

Notes

1. Polarad Model MSG-1R Microwave Signal Generator employed in conjunction with the Model T-RL Tuning Unit; Polarad Models MSG-1R and MSG-2R Microwave Signal Generators employed in conjunction with the Model T-RS Tuning Unit; Polarad Model MSG-34 Microwave Signal Generator employed in conjunction with the Model T-TM Tuning Unit; Polarad Models MSG-34 and 1709 Microwave Signal Generators employed in conjunction with the Model T-RX Tuning Unit.

2. PRD Model 587-A Frequency Meter and FXR Model N410A Frequency Meter employed in conjunction with the Model T-RL Tuning Unit; FXR Models N410A and H410A Frequency Meters employed in conjunction with the Model T-RS Tuning Unit; FXR Models H410A and C410A Frequency Meters employed in conjunction with the Model T-RM Tuning Unit; FXR Models C410A and X410A Frequency Meters employed in conjunction with the Model T-RX Tuning Unit.

3. FXR Models H601B Waveguide-to-Coax Adapters used with the Model H410A Frequency Meter; FXR Models C601B Waveguide-to-Coax Adapters used with the Model H410A Frequency Meter; FXR Models X601B Waveguide-to-Coax Adapters used with the Model X410A Frequency Meter.

Figure 4-1. Minimum Performance Standards (R-f Section), Equipment Setup

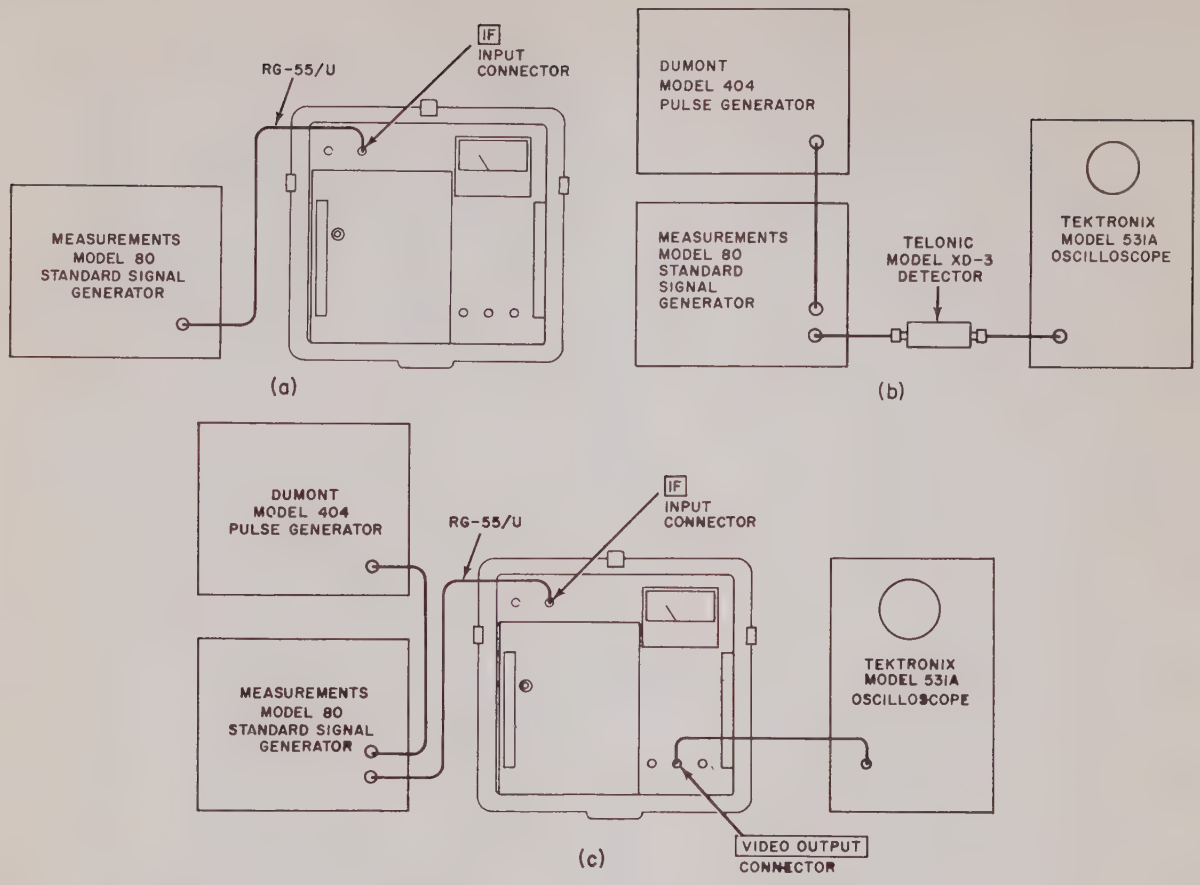


Figure 4-2. Minimum Performance Standards (I-f Section), Equipment Setup

4-15. SETTING BEAM AND REFLECTOR VOLTAGES. To set the beam and reflector voltages at their proper levels, proceed as directed in the following steps:

a. With the basic unit installed in its dust cover (without the front panel casting in place), couple either a Model T-RM or T-RX Tuning Unit to the basic unit via patch cable W35.

Note

If the Model T-RM or T-RX Tuning Unit is not available, use either the Model T-RL or T-RS Tuning Unit.

b. To insure proper air flow within the equipment, tape a 9"x 11" sheet of cardboard (with a small cutout for the patch cable) over the basic unit front panel opening created by the removal of the tuning unit.

c. Set the AFC OFF switch to OFF. Couple the Model TR to line power through a Variac. Adjust the Variac for nominal line voltage.

d. Connect a differential voltmeter-voltbox between pin 23 of the tuning unit multipin connector and tuning unit ground.

e. Energize the Model TR and allow it to warm up for at least 15 minutes. Maintain line voltage at nominal value.

f. Carefully withdraw the basic unit approximately two inches from the dust cover and set Beam Voltage Adj control R841 to obtain the proper beam voltage (-1250 volts for the Models T-RM and T-RX Tuning Units; -325 volts for the Models T-RL and T-RS Tuning Units).

g. Slide the basic unit back into the dust cover and de-energize the Model TR. Reconnect the differential voltmeter-voltbox between pin 24 of the tuning unit multipin connector and tuning unit ground.

h. Re-energize the Model TR and maintain the line voltage at nominal value.

Note

If the Model TR has been de-energized longer than 15 minutes, allow another 15-minute warmup period.

i. Carefully withdraw the basic unit approximately two inches from the dust cover and set Reflector Voltage Adj control R822 to obtain the proper reflector voltage (-1850 volts for the Models T-RM and

T-RX Tuning Units; -925 volts for the Models T-RL and T-RS Tuning Units).

j. Slide the basic unit back into the dust cover, de-energize the Model TR, and disconnect the equipment.

4-16. LOCALIZING TROUBLE to EITHER R-F or I-F CIRCUITRY.

4-17. To localize the cause of system malfunction to either the i-f or r-f circuitry, proceed as indicated in the following steps.

a. With the Model TR removed from its dust cover (refer to paragraph 4-8), disconnect P4501 from J4501, its mating receptacle on the 255-mc high-pass filter.

b. Energize the Model TR and set the Scale Selector switch to ZERO. Allow the equipment to warm up at least 15 minutes and adjust the Zero control, if necessary, to obtain an Output meter indication of CAL.

c. Set the Scale Selector switch to LIN, the WEIGHTING FUNCTION switch to AVG, and the IMPULSE BANDWIDTH-MC switch to 1.

d. Rotate the IF GAIN control fully clockwise and note the Output meter indication on the LIN scale. It should read a minimum of 8.

e. Tune a standard signal generator for a cw output at 260 mc (by means of a crystal calibrator and headset). Adjust the signal generator for minimum output power and couple the generator to J4501.

f. Set the Scale Selector switch to μV and adjust the IF GAIN control to obtain an Output meter indication of CAL.

g. Increase the signal generator output level to obtain an Output meter indication of 10 on the 1 MC range of the DB ABOVE 1 μV scale. Note the signal generator output level (in -dbm). Increase the signal generator output level exactly 50 db and note the Output meter indication. It should read 60 (±1) on the 1 Mc range of the DB ABOVE 1 μV scale. If the Output meter indications of steps b, d, and g cannot be obtained, the trouble has been localized to the i-f circuitry (refer to paragraph 4-18). If all Output meter indications are obtained, the trouble has been localized to the r-f circuitry (refer to paragraph 4-37).

4-18. LOCALIZING I-F TROUBLE TO AN INDIVIDUAL SYSTEM SUBASSEMBLY.

4-19. If the result of paragraph 4-16 indicated that the cause of system malfunction lies within the i-f circuitry, proceed as directed in table 4-7 to localize the malfunction to an individual system subassembly (see figure 4-3). Unless otherwise indicated, the front panel controls are to be set as indicated in table 4-6.

4-20. 255-MC HIGH-PASS FILTER, TROUBLESHOOTING. To troubleshoot the 255-mc high-pass filter, proceed as indicated in the following steps.

a. Disconnect P4501 and P4502 from their mating receptacles (J4501 and J4502, respectively).

b. Remove the two screws that secure the filter to the basic unit frame. Carefully remove the filter from the basic unit.

c. Remove the four screws that secure the cover plate to the filter chassis. Carefully remove the cover plate from the filter chassis. The individual components that constitute the filter will now be visible and accessible (see figure 4-5). Visually inspect the chassis for defective components.

d. Effect the necessary repairs and/or replacements. Refer to paragraph 4-21 for the alignment procedure to be employed after the necessary repairs and/or replacements have been effected.

4-21. 255-MC HIGH-PASS FILTER, ALIGNMENT. To align the 255-mc high-pass filter, proceed as directed in the following steps.

a. Adjust C4503 for minimum capacitance.

b. Tune a standard signal generator for a cw output at 220 mc (by means of a crystal calibrator and headset). Adjust for an output level of approximately -10 dbm and set for a 1,000-cps, 30% amplitude-modulated signal.

c. Connect the equipment as illustrated in figure 4-6.

d. Short either L4503 or C4503 and tune C4502 to obtain a minimum indication on the standing wave meter.

e. Remove the short of step d.

f. Short either L4501 or C4502 and tune C4505 to obtain a minimum indication on the standing wave meter.

g. Remove the short added in step f and tune the signal generator to 248 mc (maintaining the same modulation and output level as in step b).

h. Tune C4503 to obtain a minimum indication on the standing wave meter.

i. Disconnect the equipment from the setup of figure 4-6.

j. Tune the signal generator for a cw output of 255 mc.

k. Set a sweep generator for a center frequency of 255 mc and a sweep width of at least 70 mc.

l. Connect the equipment as illustrated in figure 4-7.

TABLE 4-6. PRELIMINARY CONTROL SETTINGS, LOCALIZING I-F TROUBLE

Control	Setting
WEIGHTING FUNCTION switch	AVG
IMPULSE BANDWIDTH-MC switch	1
Scale Selector switch	70 DB
AM FM switch	AM
AURAL AID OFF switch	OFF
AFC OFF switch	OFF
AUDIO GAIN control	Fully counterclockwise
SLIDEBACK control	Fully counterclockwise
IF GAIN control	Mid-position
POWER OFF switch	OFF

m. Fine-tune C4501, C4503, and C4504 to obtain the dynamic response illustrated in figure 4-8. Replace the cover plate to the filter chassis. Slight re-adjustment of C4502 and C4503 may be necessary to maintain the desired response after replacement of the cover plate.

n. Disconnect the equipment from the setup shown in figure 4-7 and reconnect as illustrated in figure 4-6.

o. Measure the insertion loss (using a 1,000-cps modulated signal) of the filter at test frequencies of 220, 230, 235, 240, 245, 248, 250, 255, and 260 mc. The insertion losses listed in table 4-8 indicate satisfactory operation.

p. Disconnect the equipment from the setup of figure 4-6.

q. Replace the filter into the basic unit and secure the former to the basic unit frame.

r. Connect P4501 and P4502 to their mating receptacles.

4-22. CRYSTAL-CONTROLLED LOCAL OSCILLATOR, TROUBLESHOOTING. To troubleshoot the crystal-controlled local oscillator, proceed as directed in the following steps.

a. With the Model TR in an energized state, check the voltage between FL301 and chassis ground (it should be -12 volts). If proper voltage is not present, check power supplies (refer to paragraph 4-12) and inter-chassis cabling.

b. With operating power removed from the Model TR, check each transistor for d-c beta. Typical betas for the transistors used in the local oscillator are listed in table 5-7. Replace all defective transistors.

Note

Remove one transistor at a time from the local oscillator and replace it before checking the next transistor.

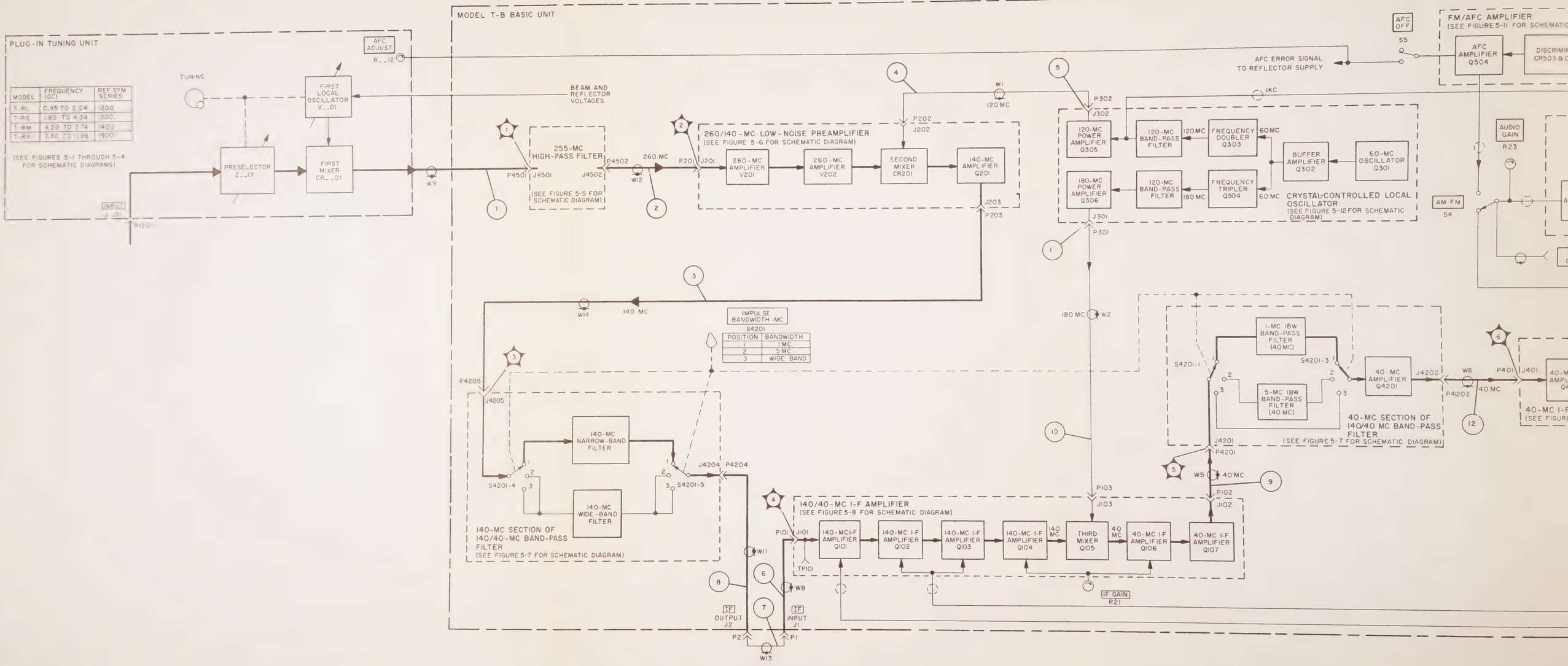
c. Withdraw the tuning unit from the basic unit (refer to paragraph 4-8) and carefully turn the basic unit on its right side.

d. Remove the 12 screws that secure the phenolic plate to the underside of the basic unit mounting deck and carefully remove the phenolic plate.

e. Remove the five screws that secure the blower mounting plate to the rear of the basic unit frame. Carefully separate the blower mounting plate from the rear of the basic unit frame. The four screws that secure the local oscillator to the basic unit mounting deck will now be accessible.

f. Disconnect P301, P302, and P303 from their mating receptacles (J301, J302, and J303, respectively) and remove the four screws that secure the local oscillator to the basic unit mounting deck. Carefully remove the local oscillator from the basic unit.

g. Remove the six screws that secure the cover plate to the local oscillator chassis and carefully remove the cover plate. The individual components that constitute the local oscillator will now be both visible and accessible (see figure 4-9). Visually inspect the chassis for defective components.


PLUG-IN TUNING UNIT
MODEL | FREQUENCY (GC) | REF SYM SERIES
T-RL | 0.95 TO 2.04 | 1200
T-RS | 1.90 TO 4.34 | 1300
T-RM | 4.20 TO 7.74 | 1400
T-RX | 7.30 TO 11.26 | 1500
(SEE FIGURES 5-1 THROUGH 5-4 FOR SCHEMATIC DIAGRAMS)
TUNING
AFC ADJUST R_ _12
FIRST LOCAL OSCILLATOR V_ _01
PRESELECTOR Z_ _01
FIRST MIXER CR_ _01
INPUT J_01
P1 P2
W9
MODEL T-B BASIC UNIT
BEAM AND REFLECTOR VOLTAGES
255-MC HIGH-PASS FILTER
(SEE FIGURE 5-5 FOR SCHEMATIC DIAGRAM)
P4501 J4501 P4502 J4502
260 MC W12
260/140-MC LOW-NOISE PREAMPLIFIER
(SEE FIGURE 5-6 FOR SCHEMATIC DIAGRAM)
P201 J201
260-MC AMPLIFIER V201
260-MC AMPLIFIER V202
SECOND MIXER CR201
140-MC AMPLIFIER Q201
P202 J202
J203 P203
W1 120 MC
P302 J302
120-MC POWER AMPLIFIER Q305
120-MC BAND-PASS FILTER
120 MC
FREQUENCY DOUBLER Q303
60 MC
BUFFER AMPLIFIER Q302
60-MC OSCILLATOR Q301
180-MC POWER AMPLIFIER Q306
120-MC BAND-PASS FILTER
180 MC
FREQUENCY TRIPLER Q304
60 MC
CRYSTAL-CONTROLLED LOCAL OSCILLATOR
(SEE FIGURE 5-12 FOR SCHEMATIC DIAGRAM)
J301 P301
1KC
AFC OFF S5
AFC ERROR SIGNAL TO REFLECTOR SUPPLY
FM/AFC AMPLIFIER
(SEE FIGURE 5-11 FOR SCHEMATIC
AFC AMPLIFIER Q504
DISCRIMIN CR503 &
AUDIO GAIN R23
AM FM S4
W14 140 MC
180 MC W2
IMPULSE BANDWIDTH-MC S4201
POSITION | BANDWIDTH
1 | 1 MC
2 | 5 MC
3 | WIDE BAND
P4205 J4205
140-MC NARROW-BAND FILTER
140-MC WIDE-BAND FILTER
S4201-4 S4201-5
J4204 P4204
140-MC SECTION OF 140/40-MC BAND-PASS FILTER
(SEE FIGURE 5-7 FOR SCHEMATIC DIAGRAM)
1-MC IBW BAND-PASS FILTER (40 MC)
5-MC IBW BAND-PASS FILTER (40 MC)
S4201-1 S4201-3
40-MC AMPLIFIER Q4201
J4202 P4202
W6 40 MC
P401 J401
40-MC SECTION OF 140/40 MC BAND-PASS FILTER
(SEE FIGURE 5-7 FOR SCHEMATIC DIAGRAM)
J4201 P4201
W5 40 MC
P103 J103
P102 J102
140/40-MC I-F AMPLIFIER
(SEE FIGURE 5-8 FOR SCHEMATIC DIAGRAM)
P101 J101
140-MC I-F AMPLIFIER Q101
140-MC I-F AMPLIFIER Q102
140-MC I-F AMPLIFIER Q103
140-MC I-F AMPLIFIER Q104
140 MC
THIRD MIXER Q105
40 MC
40-MC I-F AMPLIFIER Q106
40-MC I-F AMPLIFIER Q107
TP101
IF GAIN R21
W11 W8 W13
IF OUTPUT J2
IF INPUT J1
P2 P1

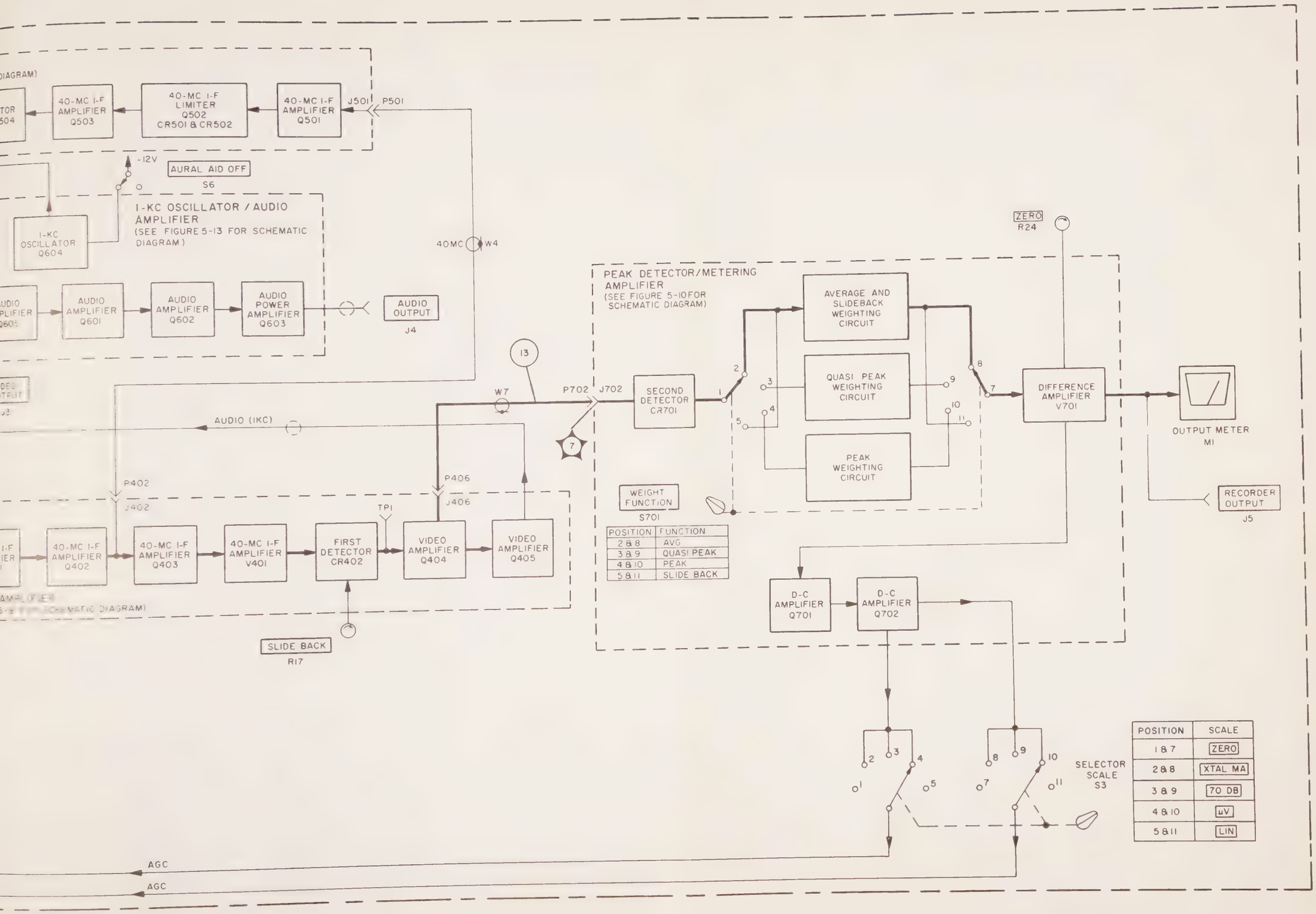


Figure 4-3. Detailed Block Diagram Showing I-f Troubleshooting Procedure Test Points

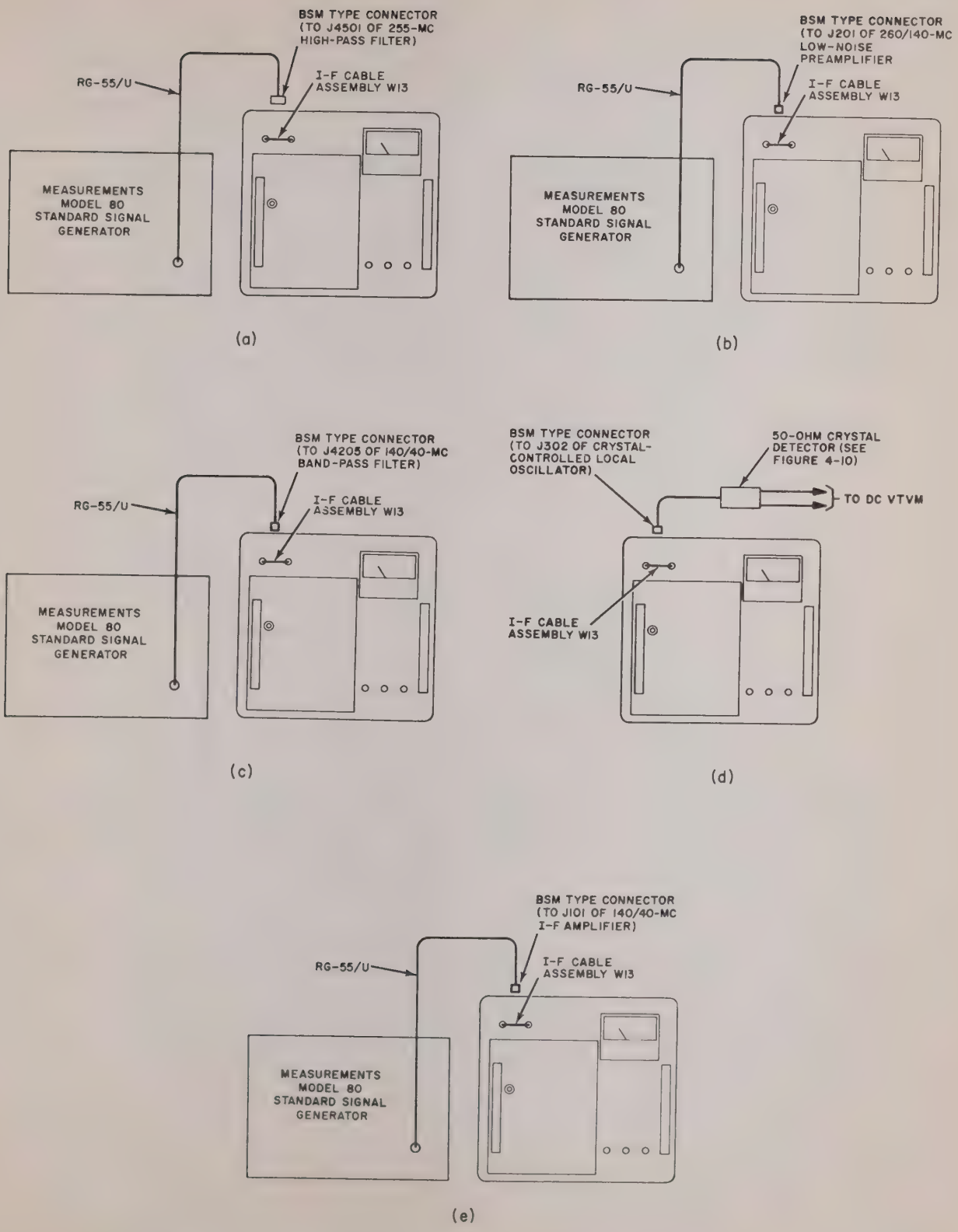


Figure 4-4. I-f Circuitry Troubleshooting, Equipment Setup (Sheet 1 of 2)

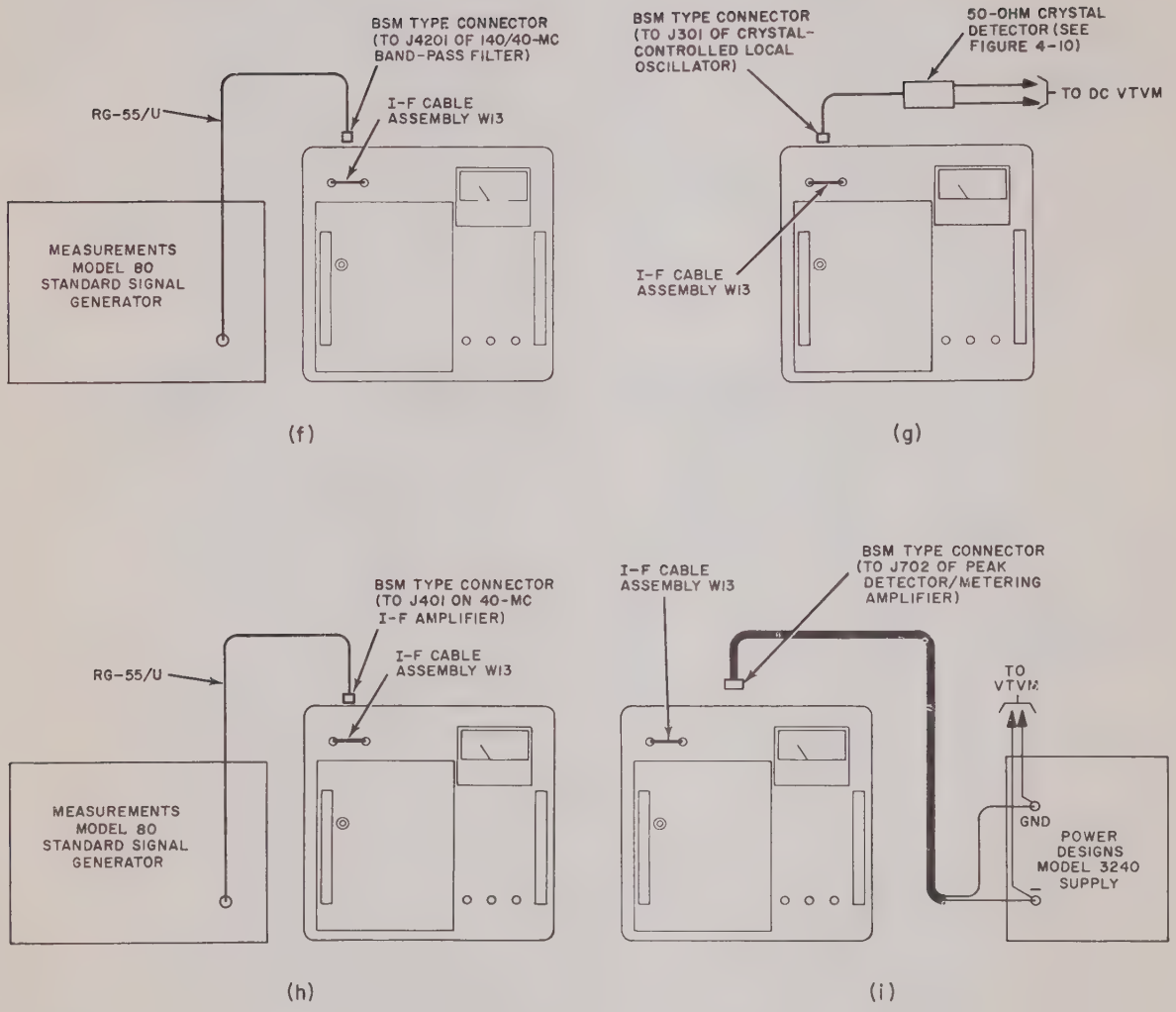


Figure 4-4. I-f Circuitry Troubleshooting, Equipment Setup (Sheet 2 of 2)

TABLE 4-7. BASIC UNIT (LESS POWER SUPPLIES) TROUBLESHOOTING PROCEDURE

Step		Instructions	Normal Indication	If Indication Is Normal	If Indication Is Abnormal
Major	Minor				
1		Disconnect P4501 (terminating i-f cable W9) from J4501, its mating receptacle on the 255-mc high-pass filter. With no signal applied to J4501, adjust the IF GAIN control to obtain an Output meter indication of CAL. Tune a standard signal generator to 260 mc (by means of a crystal calibrator and headset) and adjust for minimum output power. Connect the equipment as illustrated in figure 4-4a. Increase the signal generator output level to obtain an Output meter indication of 0 on the DB scale. Note the output level (-dbm) of the signal generator. Increase the signal generator output level exactly 70 db and note the Output meter indication.	Output meter indicates 70 (±2) on the DB scale.	Trouble lies in i-f cable W9 or tuning unit. Proceed to step (1).	Trouble lies between 255-mc high-pass filter and Output meter. Connect P4501 to J4501 and proceed to step 2.
	(1)	With operating power removed from the equipment and the tuning unit withdrawn from the basic unit, check i-f cable W9 for continuity with an ohmmeter.	Continuity from end to end of cable for both inner and outer conductors; infinite resistance between inner and outer conductors at either end of cable.	Trouble lies in tuning unit. Connect P4501 to J4501 and refer to paragraph 4-37.	Repair (or replace) defective cable. Connect repaired (or replacement) cable between J1106 and J4501.
2		Disconnect P201 (terminating i-f cable W12) from J201, its mating receptacle on the 260/140-mc low-noise preamplifier. With no signal applied to J201, adjust the IF GAIN control to obtain an Output meter indication of CAL. Adjust the signal generator (still tuned to 260 mc) for minimum output power and connect the equipment as illustrated in figure 4-4b. Increase the signal generator output level to obtain an Output meter indication of 0 on the DB scale. Note the output level (in -dbm) of the	Same as that for step 1.	Trouble lies in either i-f cable W12 or 255-mc high-pass filter. Proceed to step (2).	Trouble lies between 260/140-mc low-noise preamplifier and Output meter. Connect P201 to J201 and proceed to step 3.

(Cont'd)

TABLE 4-7. BASIC UNIT (LESS POWER SUPPLIES) TROUBLESHOOTING PROCEDURE (Cont'd)

Step		Instructions	Normal Indication	If Indication Is Normal	If Indication Is Abnormal
Major	Minor				
2 (Cont'd)		signal generator. Increase the signal generator output level exactly 70 db and note the Output meter indication.			
	2	Disconnect P4502 (terminating the other end of i-f cable W12) from J4502, its mating receptacle on the 255-mc high-pass filter. Check i-f cable W12 for continuity with an ohmmeter.	Same as that for step 1.	Trouble lies in 255-mc high-pass filter. Refer to paragraph 4-20. Repeat step 1 after repairing, aligning, and replacing the filter into the basic unit.	Repair (or replace) defective cable. Connect repaired (or replacement) cable between J4502 and J201 and repeat step 1.
3		Disconnect P4205 (terminating i-f cable W10) from J4205, its mating receptacle on the 140/40-mc band-pass filter. With no signal applied to J4205, adjust the IF GAIN control to obtain an Output meter indication of CAL. Tune the signal generator to 140 mc (by means of a crystal calibrator and headset) and adjust for minimum output power. Connect the equipment as illustrated in figure 4-4c. Increase the signal generator output level to obtain an Output meter indication of 0 on the DB scale. Note the output level (in -dbm) of the signal generator. Increase the signal generator output level exactly 70 db and note the Output meter indication.	Same as that for step 1.	Trouble lies in i-f cable W10, cable W1, 120-mc section of crystal-controlled local oscillator, or 260/140-mc low-noise preamplifier. Proceed to step 3.	Trouble lies between 140-mc section of 140/40-mc bandpass filter and Output meter. Connect P4205 to J4205 and proceed to step 4.

(Cont'd)

TABLE 4-7. BASIC UNIT (LESS POWER SUPPLIES) TROUBLESHOOTING PROCEDURE (Cont'd)

Step		Instructions	Normal Indication	If Indication Is Normal	If Indication Is Abnormal
Major	Minor				
	3	Disconnect P203 (terminating the other end of i-f cable W10) from J203, its mating receptacle on the 260/140-mc low-noise preamplifier. Check i-f cable W10 for continuity with an ohmmeter.	Same as that for step 1.	Trouble lies in cable W1, 120-mc section of crystal-controlled local oscillator; or 260/140-mc low-noise preamplifier. Connect W10 between P4205 and J203 and proceed to step 4.	Repair (or replace) defective cable. Connect repaired (or replacement) cable between P4205 and J203 and repeat step 2.
	4	Disconnect P302 (terminating cable W1) from J302, its mating receptacle on the crystal-controlled local oscillator. Disconnect P202 (terminating the other end of cable W1) from J202, its mating receptacle on the 260/140-mc low-noise preamplifier. Check cable W1 for continuity with an ohmmeter.	Same as that for step 1.	Trouble lies in 120-mc section of crystal-controlled local oscillator or 260/140-mc low-noise preamplifier. Connect P202 to J202 and proceed to step 5.	Repair (or replace) defective cable. Connect repaired (or replacement) cable between J302 and J202 and repeat step 2.
	5	With P302 still disconnected from J302, connect the equipment as illustrated in figure 4-4d and note the vtvm indication.	Vtvm indicates between 1.0 and 2.0 volts (dc).	Trouble lies in 260/140-mc low-noise preamplifier. Connect P302 to J302 and refer to paragraph 4-24. Repeat step 2 after repairing, aligning, and replacing preamplifier into basic unit.	Trouble lies in 120-mc section of crystal-controlled local oscillator. Refer to paragraph 4-22. Repeat step 2 after repairing, aligning, and replacing oscillator into basic unit.
4		Disconnect P101 (terminating i-f cable W8) from J101, its mating receptacle on the 140/40-mc i-f amplifier. With no signal applied to J101, adjust the IF GAIN control to obtain an Output meter indication of CAL. Adjust the signal generator (still tuned to 140 mc) for minimum output power and connect the	Same as that for step 1.	Trouble lies in i-f cable W8, i-f cable W13, i-f cable W11, or 140-mc section of 140/40-mc band-pass filter.	Trouble lies between 140/40-mc i-f amplifier and Output meter. Connect P101 to J101 and proceed to step 5.

(Cont'd)

TABLE 4-7. BASIC UNIT (LESS POWER SUPPLIES) TROUBLESHOOTING PROCEDURE (Cont'd)

Step		Instructions	Normal Indication	If Indication Is Normal	If Indication Is Abnormal
Major	Minor				
4 (Cont'd)		equipment as illustrated in figure 4-4e. Increase the signal generator output level to obtain an Output meter indication of 0 on the DB scale. Note the output level (in -dbm) of the signal generator. Increase the signal generator output level exactly 70 db and note the Output meter indication.		Proceed to step 6.	
	6	With P101 still disconnected from J101, disconnect P1 (terminating i-f cable W13) from IF input connector J1. Check i-f cable W8 for continuity with an ohmmeter.	Same as that for step 1.	Trouble lies in i-f cable W13, i-f cable W11, or 140-mc section of 140/40-mc band-pass filter. Connect P101 to J101 and proceed to step 7.	Repair defective cable. Connect repaired cable between J101 and basic unit front panel. Connect P1 to J1 and repeat step 3.
	7	With P1 still disconnected from J1, disconnect P2 (terminating the other end of i-f cable W13) from IF output connector J2. Check i-f cable W13 for continuity with an ohmmeter.	Same as that for step 1.	Trouble lies in i-f cable W11 or 140-mc section of 140/40-mc band-pass filter. Connect P1 to J1 and proceed to step 8.	Repair defective cable. Connect repaired cable between J1 and J2 and repeat step 3.
	8	With P2 still disconnected from J2, disconnect P4204 (terminating i-f cable W11) from J4204, its mating receptacle on the 140/40-mc band-pass filter. Check i-f cable W11 for continuity with an ohmmeter.	Same as that for step 1.	Trouble lies in 140-mc section of 140/40-mc band-pass filter. Connect P2 to J2 and refer to paragraph 4-26. Repeat step 3 after repairing, aligning, and replacing filter into basic unit.	Repair (or replace) defective cable. Connect repaired (or replacement) cable between J4204 and basic unit front panel. Connect P2 to J2 and repeat step 3.

(Cont'd)

TABLE 4-7. BASIC UNIT (LESS POWER SUPPLIES) TROUBLESHOOTING PROCEDURE (Cont'd)

Step		Instructions	Normal Indication	If Indication Is Normal	If Indication Is Abnormal
Major	Minor				
5		Set the Scale Selector switch to LIN. Disconnect P4201 (terminating i-f cable W5) from J4201, its mating receptacle on the 140/40-mc band-pass filter. With no signal applied to J4201, note the Output meter indication (it should read 0 on the LIN scale). Tune the standard signal generator to 40 mc (by means of a crystal calibrator and headset) and adjust for minimum output power. Connect the equipment as illustrated in figure 4-4f. Increase the signal generator output level to obtain an Output meter indication of 2 on the LIN scale. Note the signal generator output level (in -dbm). Increase the signal generator output level exactly 13 db and note the Output meter indication.	Output meter indicates between 8 and 10 on the LIN scale.	Trouble lies in i-f cable W5, cable W2, 180-mc section of crystal-controlled local oscillator, or 140/40-mc i-f amplifier. Proceed to step (9).	Trouble lies between 40-mc section of 140/40-mc band-pass filter and Output meter. Connect P4201 to J4201 and proceed to step 6.
	(9)	With P4201 still disconnected from J4201, disconnect P102 (terminating the other end of i-f cable W5) from J102, its mating receptacle on the 40-mc i-f amplifier. Check cable W5 for continuity with an ohmmeter.	Same as that for step (1).	Trouble lies in cable W2, 180-mc section of crystal-controlled local oscillator, or 140/40-mc i-f amplifier. Connect i-f cable W5 between J4201 and J102 and proceed to step (10).	Repair (or replace) defective cable. Connect repaired (or replacement) cable between J4201 and J102 and repeat step 4.
	(10)	Disconnect P301 (terminating cable W2) from J301, its mating receptacle on the crystal-controlled local oscillator. Disconnect P103 (terminating the other end of cable W2) from J103, its mating receptacle on the 140/40-mc i-f amplifier. Check cable W2 for continuity with an ohmmeter.	Same as that for step (1).	Trouble lies in 180-mc section of crystal-controlled local oscillator or 140/40-mc i-f amplifier. Connect P103 to J103 and proceed to step (11).	Repair (or replace) defective cable. Connect repaired (or replacement) cable between J301 and J103 and repeat step 4.

(Cont'd)

TABLE 4-7. BASIC UNIT (LESS POWER SUPPLIES) TROUBLESHOOTING PROCEDURE (Cont'd)

Step		Instructions	Normal Indication	If Indication Is Normal	If Indication Is Abnormal
Major	Minor				
	11	With P301 still disconnected from J301, connect the equipment as illustrated in figure 4-4g and note the vtvm indication.	Vtvm indicates between 0.3 and 0.7 volts (dc).	Trouble lies in 140/40-mc i-f amplifier. Connect P301 to J301 and refer to paragraph 4-28. Repeat step 4 after repairing, aligning, and replacing amplifier into basic unit.	Trouble lies in 180-mc section of crystal-controlled local oscillator. Connect P103 to J103 and refer to paragraph 4-22. Repeat step 4 after repairing, aligning, and replacing oscillator into basic unit.
6		Disconnect P401 (terminating i-f cable W6) from J401, its mating receptacle on the 40-mc i-f amplifier. With no signal applied to J401, note the Output meter indication (it should read 0 on the LIN scale). Tune the standard signal generator to 40-mc (by means of a crystal calibrator and headset) and adjust for minimum output power. Connect the equipment as illustrated in figure 4-4h. Increase the signal generator output level to obtain an Output meter indication of 2 on the LIN scale. Note the output level (in -dbm) of the signal generator. Increase the signal generator output level exactly 13 db and note the Output meter indication.	Same as that for step 5.	Trouble lies in i-f cable W6 or 40-mc section of 140/40-mc band-pass filter. Proceed to step 12.	Trouble lies between 40-mc i-f amplifier and Output meter. Connect P401 to J401 and proceed to step 7.
	12	With P401 still disconnected from J401, disconnect P4202 (terminating the other end of i-f cable W6) from J4202, its mating receptacle on the 140/40-mc band-pass filter. Check i-f cable W6 for continuity with an ohmmeter.	Same as that for step 1.	Trouble lies in 40-mc section of 140/40-mc band-pass filter. Connect P401 to J401 and refer to paragraph 4-26. Repeat step 5 after repairing, aligning, and replacing filter into basic unit.	Repair (or replace) defective cable. Connect repaired (or replacement) cable between J401 and J4202 and repeat step 5.

(Cont'd)

TABLE 4-7. BASIC UNIT (LESS POWER SUPPLIES) TROUBLESHOOTING PROCEDURE (Cont'd)

Step		Instructions	Normal Indication	If Indication Is Normal	If Indication Is Normal
Major	Minor				
7		Disconnect P702 (terminating video cable W7) from J701, its mating receptacle on the peak detector/metering amplifier. Connect the equipment as illustrated in figure 4-4i. Adjust the level of the applied voltage to obtain an Output meter indication of 7 on the LIN scale. Note the voltage required.	Voltage required to produce desired Output meter indication of 7 is between -6.4 and -8.2 volts.	Trouble lies in video cable W7 or 40-mc i-f amplifier. Proceed to step (13) .	Trouble lies in peak detector/metering amplifier. Refer to paragraph 4-30. Repeat step 6 after repairing and replacing peak detector/metering amplifier into basic unit.
	(13)	With P702 still disconnected from J702, disconnect P406 (terminating the other end of video cable W7) from J406, its mating receptacle on the 40-mc i-f amplifier. Check video cable W7 for continuity with an ohmmeter.	Same as that for step (1) .	Trouble lies in 40-mc i-f amplifier. Connect P702 to J702 and refer to paragraph 4-32. Repeat step 6 after repairing, aligning, and replacing amplifier into basic unit.	Repair (or replace) defective cable. Connect repaired (or replacement) cable between J406 and J702 and repeat step 6 .

TABLE 4-8. 255-MC HIGH-PASS FILTER INSERTION LOSS

Test Frequency (Mc)	Insertion Loss (Db)
220	32 (minimum)
230 to 248	20 (minimum)
250	10 (minimum)
260	0.7 (maximum)

h. Secure the blower mounting plate to the rear of the basic unit frame, set the basic unit in an upright position, and connect patch cable W35 between the basic unit and a tuning unit.

i. Connect P303 to J303 and energize the Model TR.

j. Measure the voltages at each transistor socket (see figure 5-12). Refer to table 5-7 for a listing of the expected voltage levels within the local oscillator.

k. De-energize the Model TR and effect the necessary repairs and/or replacements. Refer to paragraph 4-23 for the alignment procedure to be employed after the necessary repairs and/or replacements have been effected.

4-23. CRYSTAL-CONTROLLED LOCAL OSCILLATOR, ALIGNMENT. To align the crystal-controlled local oscillator, proceed as directed in the following steps.

a. Energize the Model TR and connect a high-impedance r-f voltmeter between the emitter of Q301 and chassis ground.

b. Tune T301 to obtain a voltmeter indication of 0.6 volts (rms).

c. Connect the r-f voltmeter between chassis ground and the junction of C345 and C346.

d. Tune L307 to peak the voltmeter indication. (Normal peaked reading is between 1.0 and 1.3 volts rms.)

e. Connect a 50-ohm crystal detector (see figure 4-10) to J302.

f. Adjust C323 for minimum capacitance and connect the r-f voltmeter between chassis ground and the junction of C323, C342, and C343.

g. Tune C314 to peak the voltmeter indication. (Normal peaked reading is between 1.0 and 1.5 volts rms.)

h. Remove the r-f voltmeter and connect a d-c vtvm across the output of the 50-ohm detector.

i. Tune C323, C326, and T307 to peak the vtvm indication. (Normal peaked reading is between 1.0 and 2.0 volts.)

j. Connect the 50-ohm crystal detector to J301.

k. Adjust C324 for minimum capacitance and connect the r-f voltmeter between chassis ground and the junction of C324, C340, and C341.

l. Tune C318 to peak the voltmeter indication. (Normal peaked reading is between 0.4 and 0.8 volts rms.)

m. Remove the r-f voltmeter and connect a d-c vtvm across the 50-ohm crystal detector.

n. Tune C324, C325, and T308 to peak the vtvm indication. (Normal peaked reading is between 0.3 and 0.7 volts.)

o. De-energize the Model TR and disconnect the equipment.

p. Secure the cover plate to the local oscillator chassis and secure the local oscillator assembly to the basic unit mounting deck.

q. Secure the blower mounting plate to the rear of the basic unit frame and secure the phenolic plate to the underside of the basic unit mounting deck.

r. Connect P301 and P302 to their mating receptacles.

s. Replace the tuning unit into the basic unit.

4-24. 260/140-MC LOW-NOISE PREAMPLIFIER, TROUBLESHOOTING. To troubleshoot the 260/140-mc low-noise preamplifier, proceed as directed in the following steps.

a. With the Model TR in an energized state, check the voltages (with respect to chassis ground) at C224, C227, and C229 (they should be -12 volts, +175 volts, and +6.3 volts, respectively). If proper voltages are not present, check power supplies (refer to paragraph 4-12) and inter-chassis cabling.

b. With operating power removed from the Model TR, check Q201 for d-c beta. Typical d-c beta for this transistor is listed in table 5-1. Replace defective transistor, if necessary.

c. Perform steps c and d of paragraph 4-22.

d. Disconnect P201, P202, P203, and P204 from their mating receptacles (J201, J202, J203, and J204, respectively) and remove the four screws that secure the preamplifier to the basic unit mounting deck. Carefully remove the preamplifier from the basic unit.

e. Remove the four screws that secure the cover plate to the preamplifier chassis and carefully remove the cover plate. The individual components

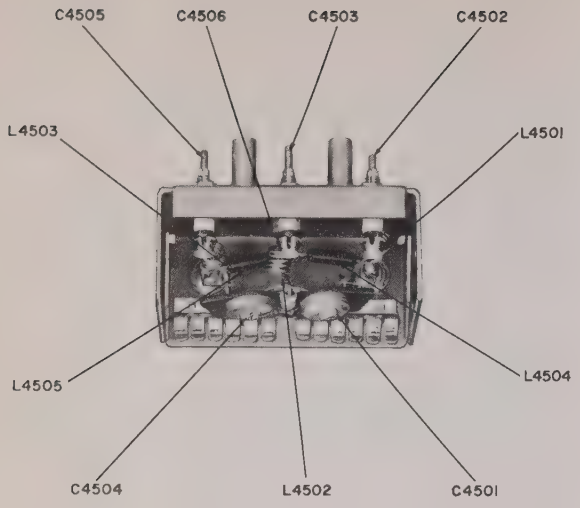


Figure 4-5. 255-Mc High-Pass Filter, Component Location Diagram

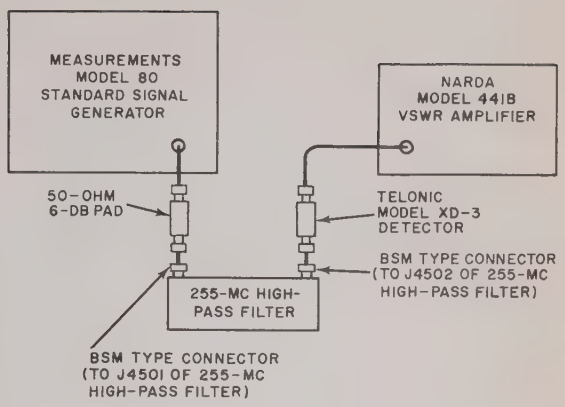


Figure 4-6. 255-Mc High-Pass Filter, Static Alignment Setup

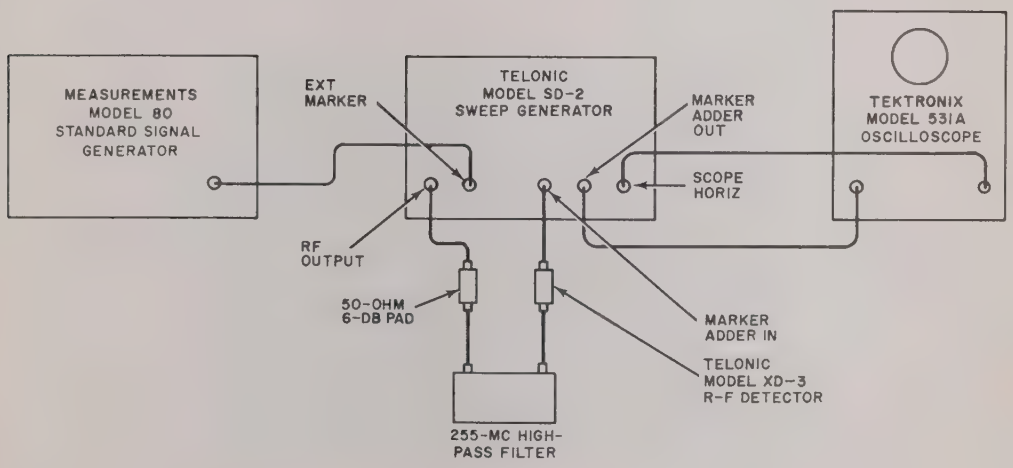


Figure 4-7. 255-Mc High-Pass Filter, Dynamic Alignment Setup

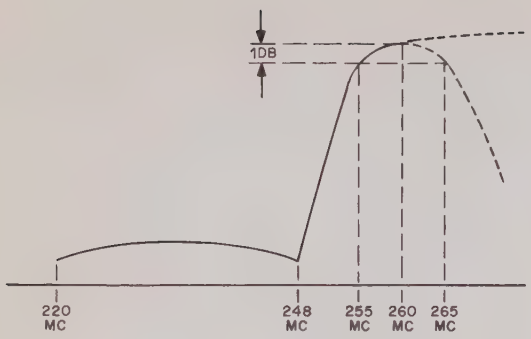


Figure 4-8. 255-Mc High-Pass Filter, Dynamic Response

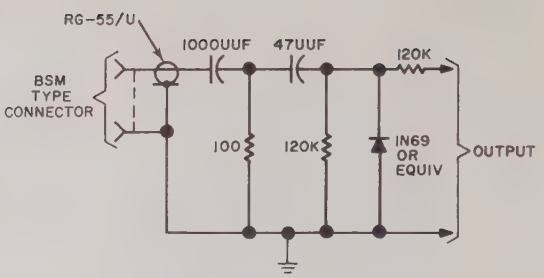


Figure 4-10. 50-ohm Crystal Detector, Schematic Diagram

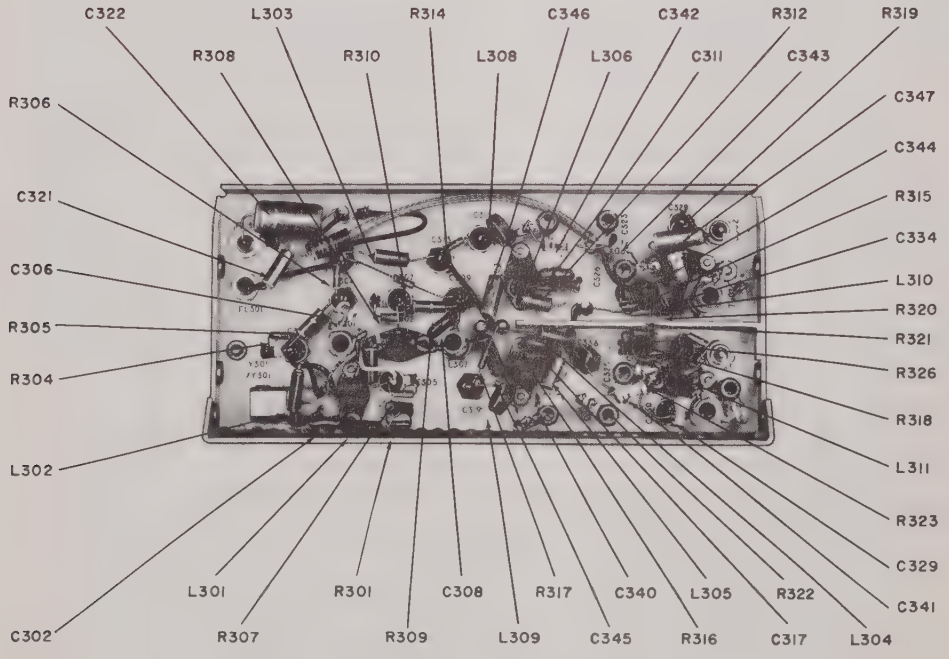


Figure 4-9. Crystal-Controlled Local Oscillator, Component Location Diagram

that constitute the preamplifier will now be both visible and accessible (see figure 4-11). Visually inspect the chassis for defective components.

f. Set the basic unit in an upright position and connect patch cable W35 between the basic unit and a tuning unit.

g. Tune a standard signal generator for a 1,000 microvolt output at 260 mc and adjust for a 1,000-cps, 30% amplitude-modulated signal. Connect the signal generator to J201.

h. Connect P202 to J202.

i. Unsolder (at the ground lug) the short length of wire connecting FL201 to chassis ground. Connect the positive terminal of a Simpson Model 373 d-c milliammeter to FL201; connect the common terminal to chassis ground.

j. Energize the Model TR.

k. Measure the voltages at the electrodes of both vacuum tubes and the transistor (see figure 5-6). Refer to table 5-1 for a listing of the expected voltage levels within the preamplifier.

l. Disconnect the signal generator from J201 and note the milliammeter indication. A reading between 0.4 and 0.7 ma indicates the diode mixer is functioning properly.

m. De-energize the equipment, solder the wire from FL201 to the ground lug, and effect the necessary repairs and/or replacements.

n. Secure the cover plate to the preamplifier chassis. Refer to paragraph 4-25 for the alignment procedure to be employed after the necessary repairs and/or replacements have been effected.

4-25. 260/140-MC LOW-NOISE PREAMPLIFIER, ALIGNMENT. To align the 260/140-mc low-noise preamplifier, proceed as indicated in the following steps.

Note

The following procedure assumes that the crystal-controlled local oscillator, 255-mc high-pass filter, and 140/40-mc band-pass filter are functioning properly.

a. Set L203 and C203 to mid-position and adjust C237 for minimum capacitance.

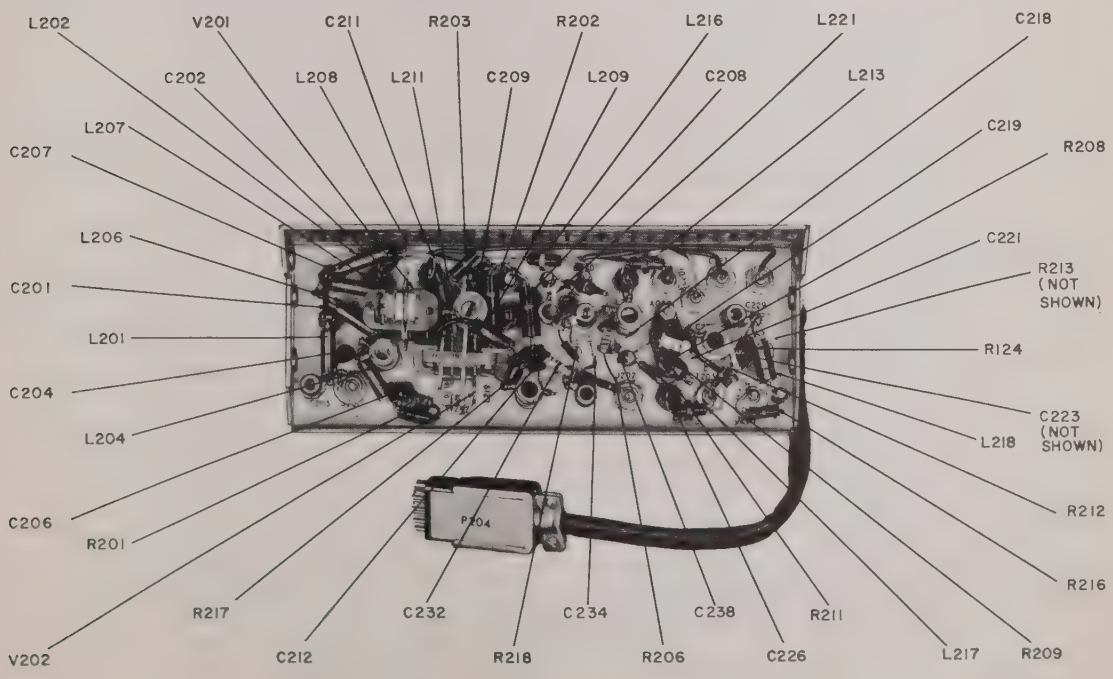


Figure 4-11. 260/140-Mc Low-Noise Preamplifier, Component Location Diagram

b. Energize the Model TR.

c. Connect a 50-ohm crystal detector (see figure 4-10) between J203 and a d-c vtvm. Tune C237 to obtain a minimum vtvm indication.

d. Tune a standard signal generator for a cw output at 260 mc (by means of a crystal calibrator and headset).

e. Tune a sweep generator for an output centered about 260 mc and adjust for minimum output power.

f. Connect the equipment as illustrated in figure 4-12.

g. Adjust the output levels of both the sweep generator and signal generator to obtain a convenient, undistorted oscilloscope display.

Note

The preamplifier should be tested for linear operation by inserting 6-db of attenuation in the sweep generator output line. If the oscilloscope display is reduced by at least one-half, the preamplifier is operating within its linear region. If inserting 6 db results in the display being reduced by less than a factor of 2, the preamplifier is operating in its saturated region and the sweep generator output level must be reduced.

h. Tune T203 to peak the response at 260 mc.

i. Tune L212, L219, T201, C233, and C236 to obtain the dynamic response illustrated in figure 4-13.

j. Disconnect the sweep generator output from J201 and couple the signal to J4501 on the 255-mc high-pass filter. Couple the output of the filter to J201.

k. Tune L203 and C203 to obtain the best match, as indicated by the combined dynamic response.

l. Disconnect the 50-ohm crystal detector from J203 and connect it to J4204 on the 140/40-mc bandpass filter. Couple the preamplifier output to J4205.

m. Set the IMPULSE BANDWIDTH-MC switch to WIDEBAND.

n. Retune T203 to obtain the best match, as illustrated in the overall dynamic response of figure 4-14. Slight retuning of the elements mentioned in step i may be necessary.

o. Note the amplitude (at the 260-mc marker) of the oscilloscope display.

p. Adjust the attenuator in the sweep generator output line for maximum attenuation and increase the sweep generator output level to obtain the same oscilloscope display amplitude noted in step o.

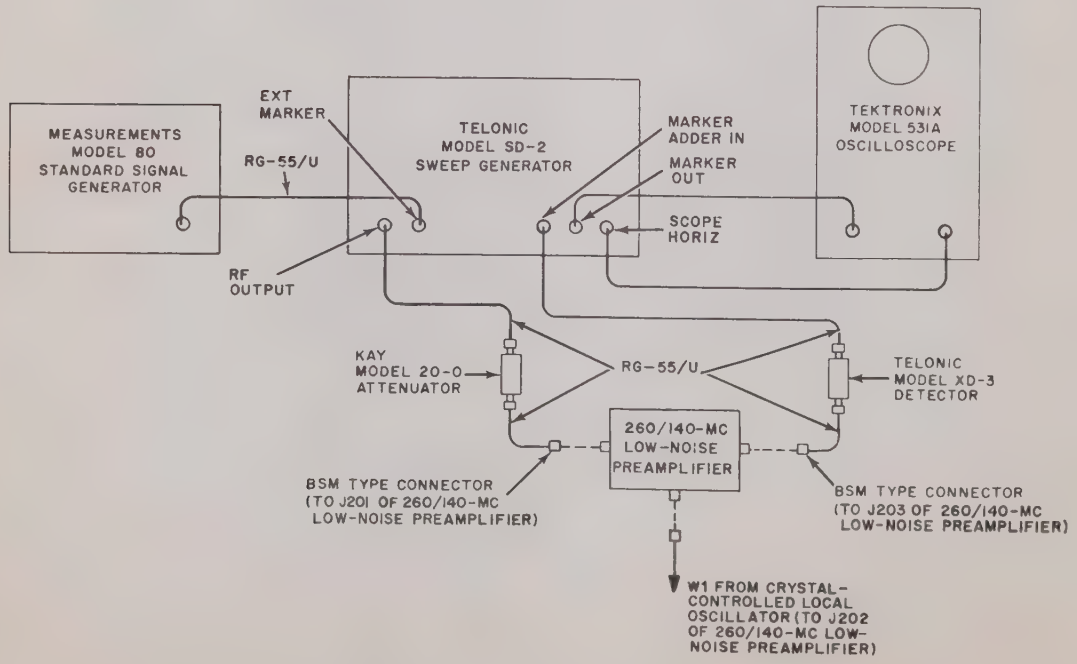


Figure 4-12. 260/140-Mc Low-Noise Preamplifier, Dynamic Alignment Setup

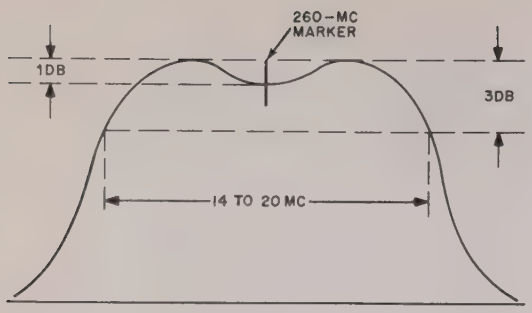


Figure 4-13. 260/140-Mc Low-Noise Preamplifier, Dynamic Response

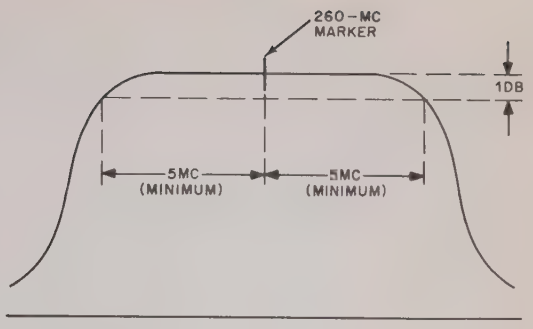


Figure 4-14. Combined Dynamic Response (255-Mc High-Pass Filter, 260/140-Mc Low-Noise Preamplifier, and 140-Mc Section of 140/40-Mc Band-Pass Filter)

q. Couple the output of the attenuator (in the sweep generator output line) directly to the detector.

r. Remove attenuation until the amplitude of the oscilloscope display is equal to that noted in step o. Note the amount of attenuation removed. An overall gain (including filters) of at least 20 db indicates satisfactory preamplifier operation.

s. De-energize and disconnect the equipment.

t. Replace the preamplifier into the basic unit and secure the former to the basic unit mounting deck.

u. Secure the phenolic plate to the underside of the basic unit mounting deck.

v. Connect P201, P202, and P204 to their mating receptacles.

w. Replace the tuning unit into the basic unit.

4-26. 140/40-MC BAND-PASS FILTER, TROUBLESHOOTING. To troubleshoot the 140/40-mc band-pass filter, proceed as directed in the following steps.

a. With the Model TR in an energized state, check the voltage (with respect to chassis ground) at FL4201 (it should be -12 volts. If proper voltage is not present, check power supplies (refer to paragraph 4-12) and inter-chassis cabling.

b. With operating power removed from the Model TR, check Q4201 for d-c beta. Typical d-c beta for this transistor is listed in table 5-2. Replace defective transistor, if necessary.

c. Disconnect P4201, P4202, P4203, P4204, and P4205 from their mating receptacles (J4201, J4202, J4203, J4204, and J4205, respectively).

d. Loosen and remove the two setscrews that secure the IMPULSE BANDWIDTH-MC knob to the switch shaft. Remove the nut and lockwasher from the switch bushing and carefully remove the filter from its mounting on the basic unit front panel.

c. Remove the eight screws that secure the cover plate to the filter chassis and carefully remove the cover plate. The individual components that constitute the filter will now be both visible and accessible.

d. Examine the filter for shorts, opens, poor switch contacts, etc.

e. De-energize the Model TR and effect the necessary repairs and/or replacements.

f. Replace the cover plate to the filter chassis. Refer to paragraph 4-27 for the alignment procedure to be employed after the necessary repairs and/or replacements have been effected.

4-27. 140/40-MC BAND-PASS FILTER, ALIGNMENT. To align the 140/40-mc band-pass filter, proceed as directed in the following steps.

a. Tune a standard signal generator for a cw output at 140 mc (by means of a crystal calibrator and headset).

b. Set a sweep generator for an output centered at 140 mc and a sweep width of at least 40 mc.

c. Connect P4203 to J4203 and connect the equipment as illustrated in figure 4-15.

d. Set the control shaft of the IMPULSE BANDWIDTH-MC switch fully clockwise (corresponding to the WIDEBAND position).

e. Adjust the output levels of both the signal generator and sweep generator to obtain a convenient undistorted oscilloscope display.

f. Tune C4219, L4206, and L4209 to obtain the dynamic response illustrated in figure 4-16.

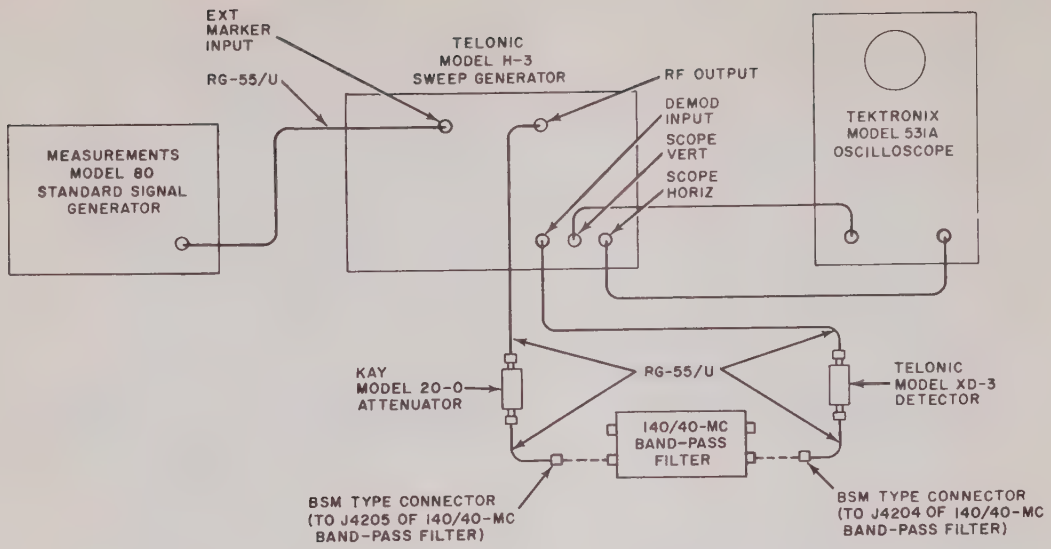


Figure 4-15. 140/40-Mc Band-Pass Filter, Dynamic Alignment Setup (140-Mc Section)

Note

The insertion loss of the filter should be between 4 and 5 db. The 20-db points of the skirts should lie above 123 mc and below 158 mc. Sidelobes, if any, must be at least 20 db down.

g. Set the IMPULSE BANDWIDTH-MC switch control shaft fully counterclockwise and tune C4224, C4228, and C4229 to obtain the dynamic response illustrated in figure 4-17.

Note

The insertion loss of the filter should be between 4 and 5 db. The 20-db points of the skirts should lie above 134 mc and below 146 mc. Sidelobes, if any, should be at least 20 db down.

h. Tune the standard signal generator for a cw output at 40 mc (by means of a crystal calibrator and headset).

i. Set the sweep generator for an output centered at 40 mc and a sweep width of at least 40 mc.

j. Connect the equipment as illustrated in figure 4-18.

k. Set the IMPULSE BANDWIDTH-MC switch shaft fully clockwise and adjust the output levels of both the signal generator and sweep generator to obtain a convenient, undistorted oscilloscope display.

l. Set Wideband Adj control R4202 for an oscilloscope display that is approximately one-half the maximum obtainable display and tune C4217 to center the response, as illustrated in figure 4-19.

m. Adjust the sweep generator output level to obtain a response having a peak amplitude of 10 to 15 millivolts, as determined by the oscilloscope display. Note this amplitude.

n. Set the IMPULSE BANDWIDTH-MC switch control shaft mid-position and tune C4202, C4203, and C4204 to obtain the dynamic response illustrated in figure 4-20.

o. Set 5 Mc Adj control R4201 to obtain the same peak amplitude as in step m.

p. Set the IMPULSE BANDWIDTH-MC switch control shaft fully counterclockwise and tune C4207, C4209, and C4212 to obtain the dynamic response illustrated in figure 4-21.

q. Note the peak amplitude of this response. Reset the IMPULSE BANDWIDTH-MC switch control shaft to mid-position and reset 5 Mc Adj control R4201 to obtain the same peak amplitude. Set the IMPULSE BANDWIDTH-MC switch control shaft fully clockwise and reset Wideband Adj control R4202 to obtain the same peak amplitude.

r. De-energize and disconnect the equipment.

s. Replace the filter into the basic unit and secure to the basic unit front panel. Replace the knob on the IMPULSE BANDWIDTH-MC switch control shaft.

t. Connect P4201, P4202, P4204, and P4205 to their mating receptacles.

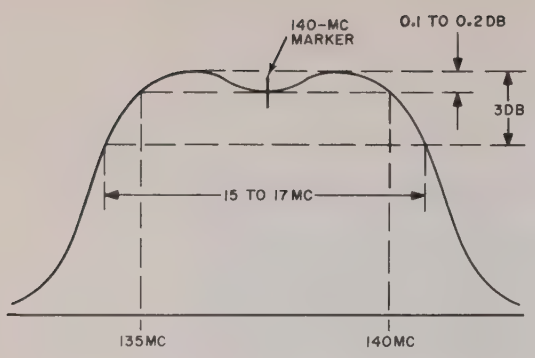


Figure 4-16. 140/40-Mc Band-Pass Filter, Dynamic Response (140-Mc Section, WIDEBAND Position)

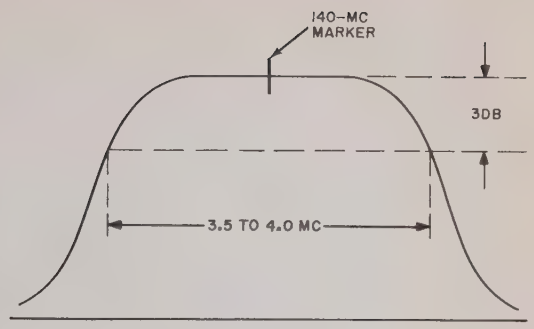


Figure 4-17. 140/40-Mc Band-Pass Filter, Dynamic Response (140-Mc Section, 1 Position)

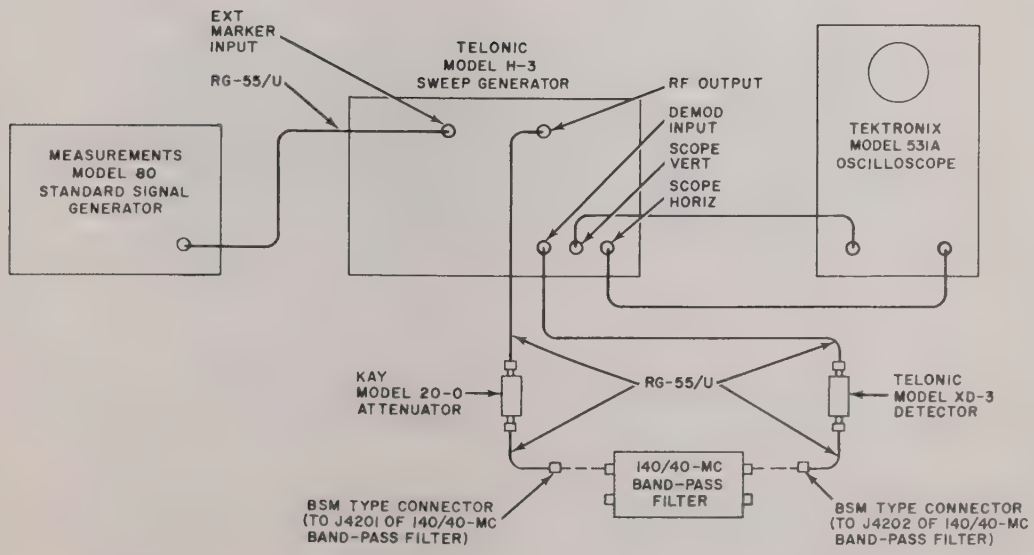


Figure 4-18. 140/40-Mc Band-Pass Filter, Dynamic Alignment Setup (40-Mc Section)

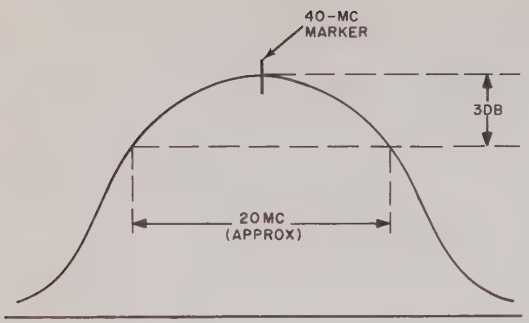


Figure 4-19. 140/40-Mc Band-Pass Filter, Dynamic Response (40-Mc Section, WIDEBAND Position)

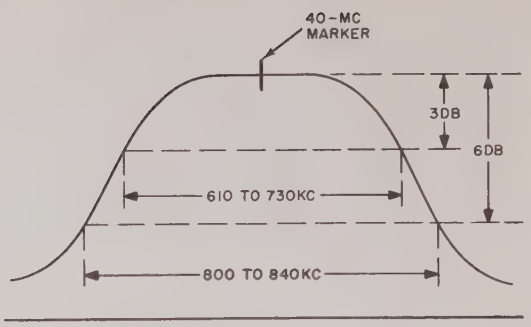


Figure 4-21. 140/40-Mc Band-Pass Filter, Dynamic Response (40-Mc Section, 1 Position)

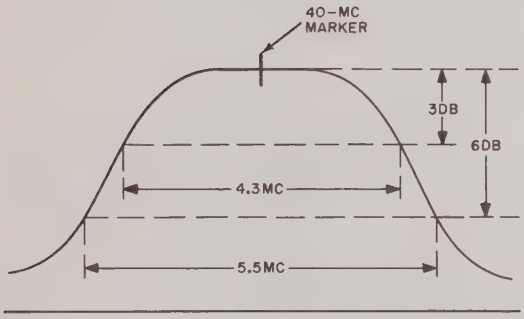


Figure 4-20. 140/40-Mc Band-Pass Filter, Dynamic Response (40-Mc Section, 5 Position)

4-28. 140/40-MC I-F AMPLIFIER, TROUBLESHOOTING. To troubleshoot the 140/40-mc i-f amplifier, proceed as indicated in the following steps.

a. With the Model TR in an energized state, check the voltage (with respect to chassis ground) at FL1 (it should be -12 volts). If proper voltage is not present, check power supplies (refer to paragraph 4-12) and inter-chassis cabling.

b. With operating power removed from the Model TR, check each transistor for d-c beta. Typical betas for the transistors used in the amplifier are listed in table 5-3. Replace all defective transistors.

Note

Remove one transistor at a time from the amplifier and replace it before checking the next transistor.

c. Perform steps c and d of paragraph 4-22.

d. Disconnect P101, P102, P103, and P104 from their mating receptacles (J101, J102, J103, and J104, respectively) and remove the four screws that secure the amplifier to the basic unit mounting deck. Carefully remove the amplifier from the basic unit.

e. Remove the four screws that secure the cover plate to the amplifier chassis and carefully remove the cover plate. The individual components that constitute the amplifier will now be both visible and accessible (see figure 4-22). Visually inspect the chassis for defective components.

f. Set the basic unit in an upright position and connect patch cable W35 between the basic unit and a tuning unit.

g. Couple P104 to a 12-volt power supply, as illustrated in figure 4-23.

h. Connect P103 to J103.

Note

This procedure assumes that the cyrstal-controlled local oscillator is functioning properly.

i. Tune a standard signal generator for a cw output of approximately -40 dbm at 140 mc (by means of a crystal calibrator and headset). Adjust the signal generator for a 1,000-cps, 30% amplitude-modulated signal.

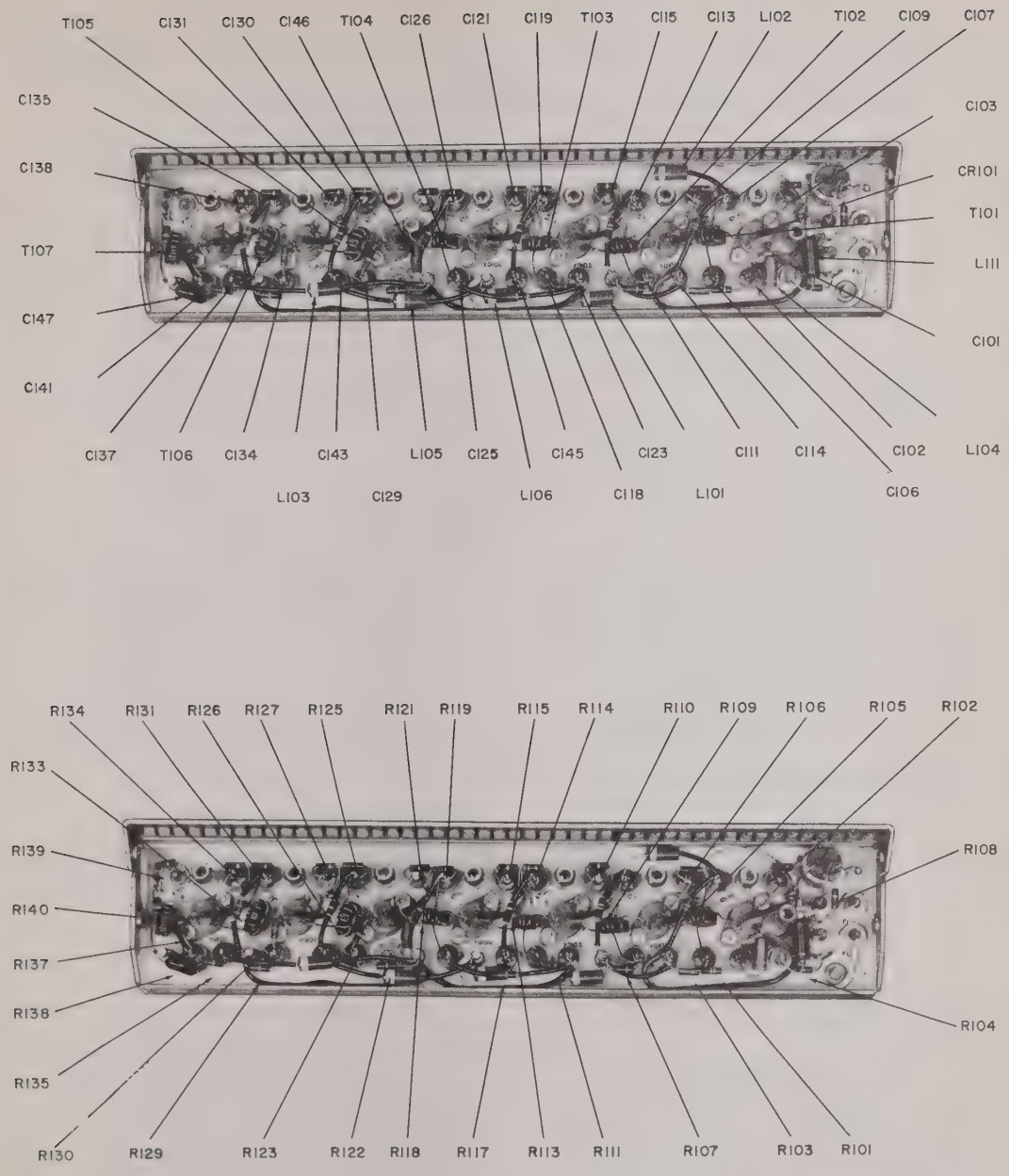


Figure 4-22. 140/40-Mc I-f Amplifier, Component Location Diagram

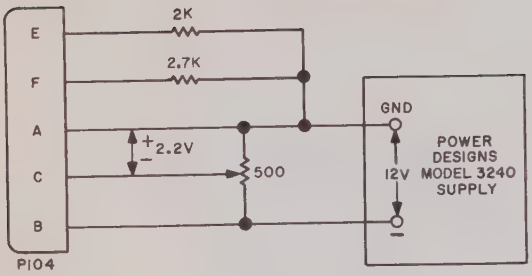


Figure 4-23. 140/40-Mc I-f Amplifier, Power Connection

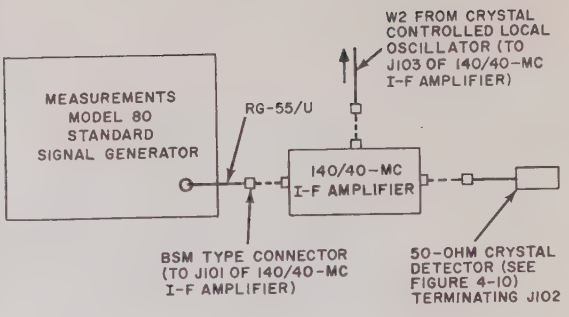

W2 FROM CRYSTAL CONTROLLED LOCAL OSCILLATOR (TO J103 OF 140/40-MC I-F AMPLIFIER)
MEASUREMENTS MODEL 80 STANDARD SIGNAL GENERATOR
RG-55/U
140/40-MC I-F AMPLIFIER
BSM TYPE CONNECTOR (TO J101 OF 140/40-MC I-F AMPLIFIER)
50-OHM CRYSTAL DETECTOR (SEE FIGURE 4-10) TERMINATING J102

Figure 4-24. 140/40-Mc I-f Amplifier, Troubleshooting Setup

j. Connect the equipment as illustrated in figure 4-24.

k. Energize the Model TR.

l. Defects within the amplifier may be localized by measuring the d-c voltages at the base connectors of the transistor sockets (see figure 5-8) and by signal tracing with a high impedance-low capacitance probe (see figure 4-25). Refer to table 5-3 for a listing of the expected voltage levels within the amplifier.

m. De-energize the equipment and effect the necessary repairs and/or replacements.

n. Secure the cover plate to the amplifier chassis. Refer to paragraph 4-29 for the alignment procedure to be employed after the necessary repairs and/or replacements have been effected.

4-29. 140/40-MC I-F AMPLIFIER, ALIGNMENT. To align the 140/40-mc i-f amplifier, proceed as indicated in the following steps.

a. Tune a standard signal generator for a cw output at 35 mc.

b. Set a sweep generator for an output centered at 35 mc, a sweep width of at least 25 mc, and adjust for minimum output power.

c. With power being supplied to the amplifier as illustrated in figure 4-23, connect the equipment as shown in figure 4-26 and energize the Model TR.

d. Adjust the output levels of both the signal generator and sweep generator to obtain a convenient, undistorted oscilloscope display.

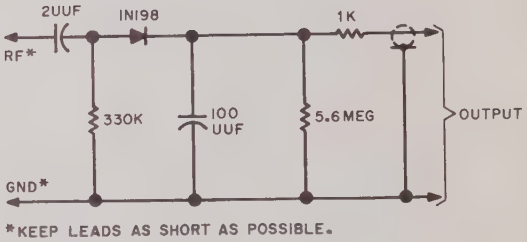


Figure 4-25. High Impedance-Low Capacitance Probe, Schematic Diagram

Note

The amplifier should be tested for linear operation by inserting 6-db of attenuation in the sweep generator output line. If the oscilloscope display is reduced by at least one-half, the amplifier is operating within its linear region. If inserting 6 db results in the display being reduced by less than a factor of 2, the amplifier is operating in its saturated region and the sweep generator output level must be reduced.

e. Tune C127, C133, and C139 to obtain the dynamic response illustrated in figure 4-27.

f. Disconnect both the sweep generator and signal generator from the setup of figure 4-26. Set the

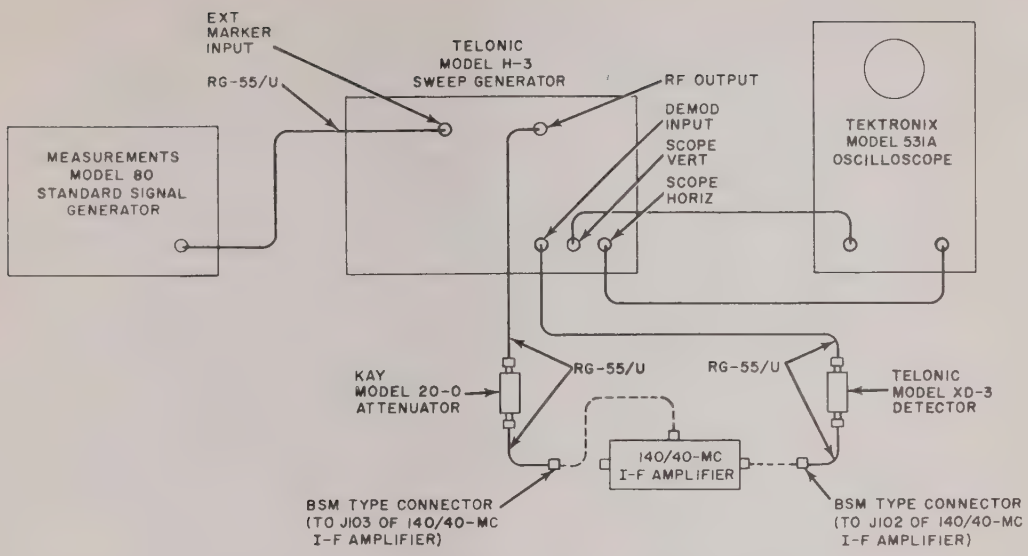


Figure 4-26. 140/40-Mc I-f Amplifier, Dynamic Alignment Setup (40-Mc Stages)

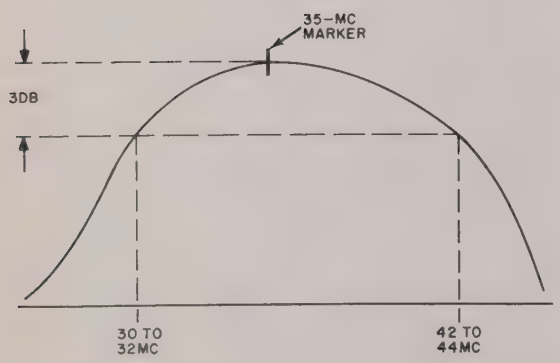


Figure 4-27. 140/40-Mc I-f Amplifier, Dynamic Response (40-Mc Stages)

sweep generator for an output centered about 130 mc, a sweep width of at least 40 mc, and adjust for minimum output power. Tune the standard signal generator for a cw output at 130 mc (by means of a crystal calibrator and headset).

g. Connect the equipment as illustrated in figure 4-28 and adjust the output levels of both the sweep generator and signal generator to obtain a convenient, undistorted oscilloscope display. (See note following step d.)

h. Adjust C148 for minimum capacitance and tune C105, C110, C117, and C122 to obtain the dynamic response illustrated in figure 4-29.

i. Disconnect the signal generator and sweep generator from the setup of figure 4-28. Set the sweep generator for an output centered at 140 mc, a sweep width of at least 40 mc, and adjust for minimum output power. Tune the signal generator for a cw output at 140 mc.

j. Connect the equipment as illustrated in figure 4-30 and adjust the output levels of both the signal generator and sweep generator to obtain a convenient, undistorted oscilloscope display. (See note following step d.)

k. Fine-tune C105, C110, C117, C122, C127, C133, and/or C139, as required, to obtain the overall dynamic response illustrated in figure 4-31.

l. Replace the Kay attenuator of figure 4-30 with a Daven attenuator. Adjust the attenuator for 0 db insertion loss.

m. Note the amplitude (at the 140-mc marker) of the oscilloscope display.

n. Adjust the attenuator for maximum insertion loss and increase the sweep generator output level to obtain the same oscilloscope amplitude noted in step m.

o. Couple the attenuator output directly to the detector.

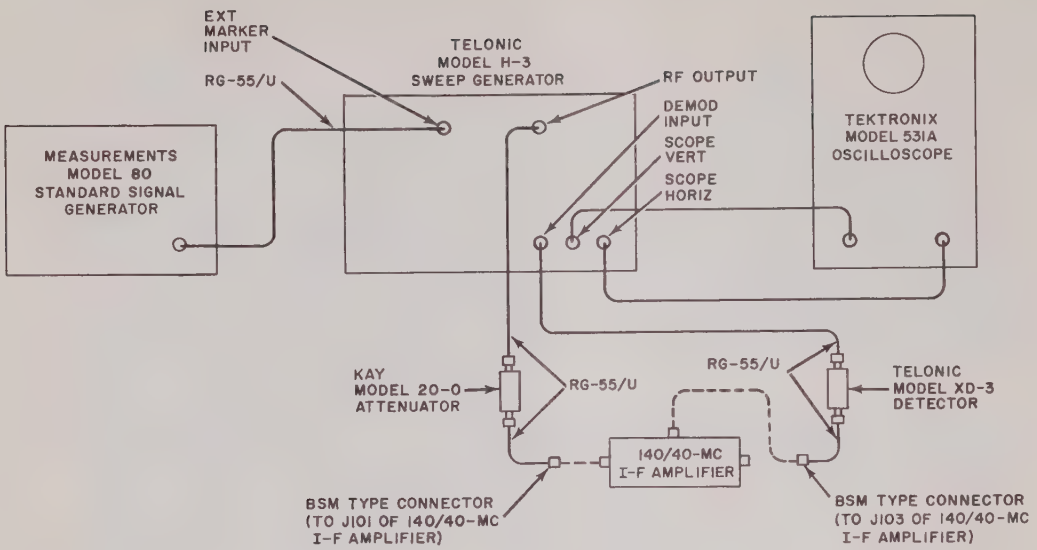


Figure 4-28. 140/40-Mc I-f Amplifier, Dynamic Alignment Setup (140-Mc Stages)

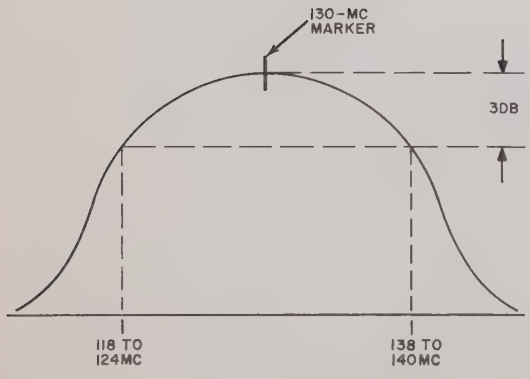


Figure 4-29. 140/40-Mc I-f Amplifier, Dynamic Response (140-Mc Stages)

p. Remove attenuation until the amplitude of the oscilloscope display is equal to that noted in step m. Note the amount of attenuation removed. An amplifier gain of at least 55 db indicates satisfactory operation.

q. Disconnect the equipment from the setup of figure 4-30.

r. Tune the signal generator for a cw output at 120 mc (by means of a crystal calibrator and headset) and then adjust for a 1,000-cps, 30% amplitude-modulated signal.

s. Connect the equipment as illustrated in figure 4-32.

t. Tune C148 to obtain a minimum indication on the standing wave meter.

u. De-energize and disconnect the equipment.

v. Replace the amplifier into the basic unit and secure the former to the basic unit mounting deck.

w. Secure the phenolic plate to the underside of the basic unit mounting deck.

x. Connect P101, P102, P103, and P104 to their mating receptacles.

y. Replace the tuning unit into the basic unit.

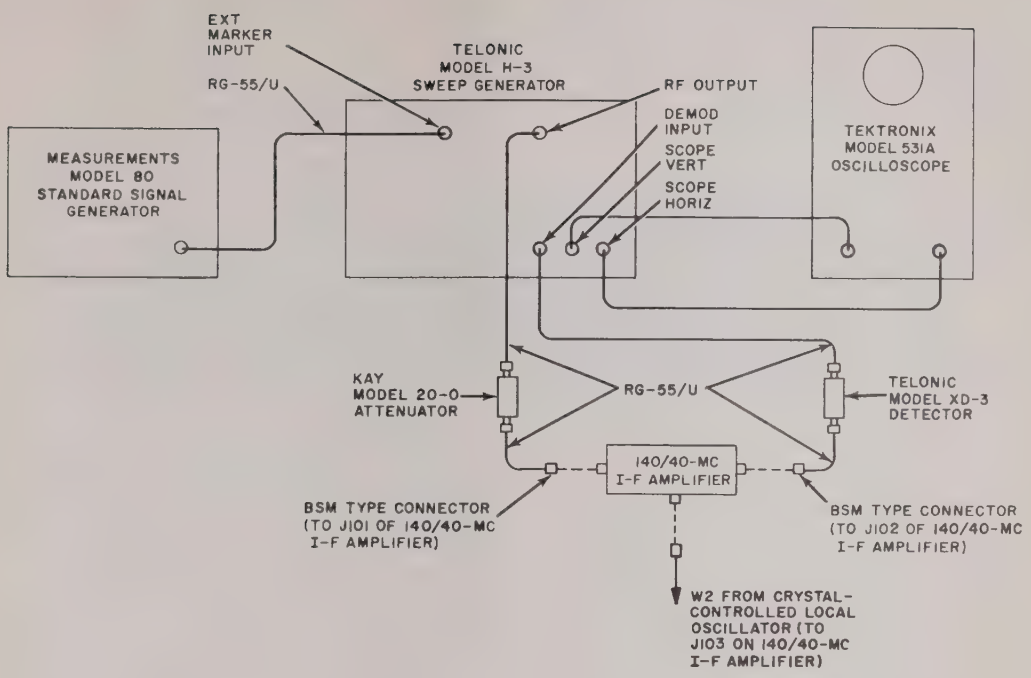


Figure 4-30. 140/40-Mc I-f Amplifier, Overall Dynamic Alignment Setup

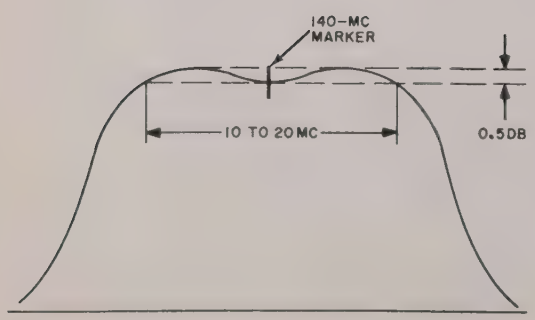


Figure 4-31. 140/40-Mc I-f Amplifier, Overall Dynamic Response

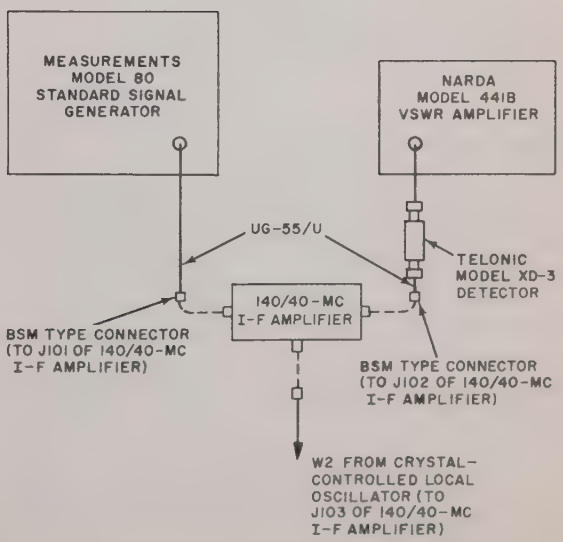


Figure 4-32. 140/40-Mc I-f Amplifier, Final Alignment Setup

4-30. PEAK DETECTOR/METERING AMPLIFIER, TROUBLESHOOTING. To troubleshoot the peak detector/metering amplifier, proceed as indicated in the following steps.

a. With operating power removed from the Model TR, disconnect P701 and P702 from their mating receptacles (J701 and J702, respectively).

b. Loosen the two setscrews that secure the WEIGHTING FUNCTION knob to the switch shaft. Remove the nut and lockwasher from the switch bushing and carefully remove the peak detector/metering amplifier from its mounting on the basic unit front panel.

c. Remove the eight screws that secure the cover plate to the peak detector/metering amplifier chassis and carefully remove the cover plate. The individual components that constitute the chassis will now be both visible and accessible. Visually inspect the chassis for defective components.

d. Energize the Model TR and measure the voltages (with respect to pin A) at pins B, C, E, and U of J701 (they should be -12 volts, -6.3 volts, +135 volts, and +6.3 volts, respectively). If proper voltage levels are not present, check power supplies (refer to paragraph 4-12) and inter-chassis cabling.

e. De-energize the equipment, connect P701 to J701, and re-energize the Model TR. Defects within the peak detector/metering amplifier may be localized by measuring the various voltage levels within the chassis. (Refer to figure 5-10 and table 5-5.)

f. De-energize the Model TR and effect the necessary repairs and/or replacements.

Note

The transistors in the peak detector/metering amplifier are soldered into the circuit.

g. Secure the cover plate to the peak detector/metering amplifier and replace the assembly into the basic unit. Secure the peak detector/metering amplifier to the basic unit front panel and replace the knob on the WEIGHTING FUNCTION switch shaft. Connect P702 to J702. The alignment procedure to be employed after the necessary repairs and/or replacements have been effected is contained in paragraph 4-33.

4-31. 40-MC I-F AMPLIFIER, TROUBLESHOOTING. To troubleshoot the 40-mc i-f amplifier, proceed as directed in the following steps.

a. With the Model TR in an energized state, check the voltages (with respect to chassis ground) at C431, C432, C433 and C439 (they should be -12 volts, +135 volts, +6.3 volts, and -24 volts, respectively). If proper voltages are not present, check power supplies (refer to paragraph 4-12) and inter-chassis cabling.

b. With operating power removed from the Model TR, check each transistor for d-c beta. Typical betas for the transistors used in the amplifier are listed in table 5-4. Replace all defective transistors.

Note

Remove one transistor at a time from the amplifier and replace it before checking the next transistor.

c. Perform steps c and d of paragraph 4-22.

d. Disconnect P401, P405, and P406 from their mating receptacles (J401, J405, and J406, respectively) and remove the four screws that secure the amplifier to the basic unit mounting deck. Carefully remove the amplifier from the basic unit.

e. Remove the four screws that secure the cover plate to the amplifier chassis and carefully remove the cover plate. The individual components that constitute the amplifier will now be both visible and accessible (see figure 4-33). Visually inspect the chassis for defective components.

f. Set the basic unit in an upright position and connect patch cable W35 between the basic unit and a tuning unit.

g. Tune a standard signal generator for a cw output of approximately -30 dbm at 40 mc (by means of a crystal calibrator and headset). Adjust the signal generator for a 1,000-cps, 30% amplitude-modulated signal.

h. Connect the equipment as illustrated in figure 4-34.

i. Connect P405 to J405 and energize the Model TR.

j. Defects within the amplifier may be localized by measuring the d-c voltages at the tube and transistor sockets (see figure 5-9) and by signal tracing with a high impedance-low capacitance probe (see figure 4-25). Refer to table 5-4 for a listing of the expected d-c voltage levels within the amplifier.

k. De-energize the equipment and effect the necessary repairs and/or replacements. Refer to paragraph 4-32 for the alignment procedure to be employed after the necessary repairs and/or replacements have been effected.

4-32. 40-MC I-F AMPLIFIER, ALIGNMENT. To align the 40-mc i-f amplifier, proceed as directed in the following steps.

a. Short both C435 and C441 to chassis ground.

b. Adjust both C449 and C421 for minimum capacitance.

c. Tune a standard signal generator for a cw output at 40 mc (by means of a crystal calibrator and headset).

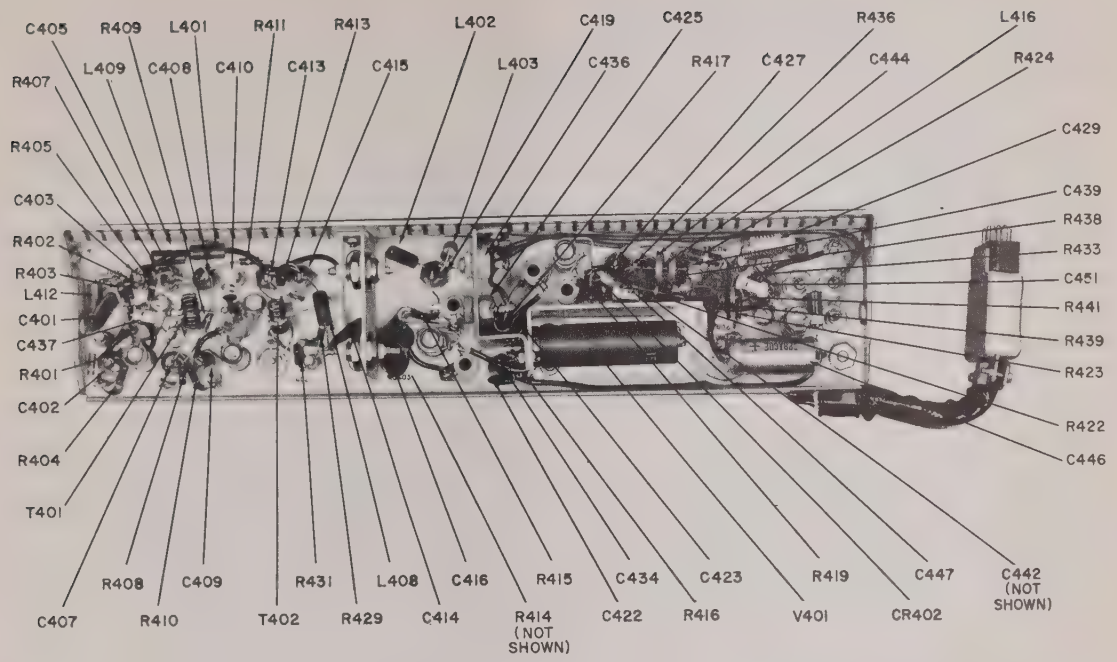


Figure 4-33. 40-Mc I-f Amplifier, Component Location Diagram

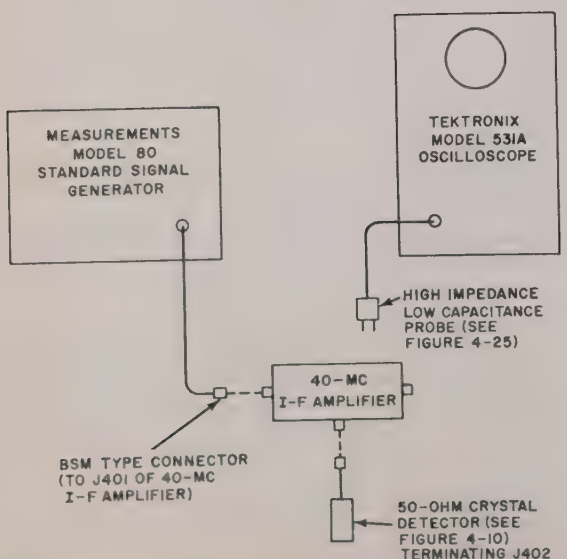


Figure 4-34. 40-Mc I-f Amplifier, Troubleshooting Setup

d. Set a sweep generator for an output centered about 40 mc, a sweep width of at least 20 mc, and adjust for minimum output power.

e. Connect the equipment as illustrated in figure 4-35 and energize the Model TR.

f. Adjust the output levels of both the signal generator and sweep generator to obtain a convenient, undistorted oscilloscope display.

Note

The amplifier should be tested for linear operation by inserting 6-db of attenuation in the sweep generator output line. If the oscilloscope display is reduced by at least one-half, the amplifier is operating within its linear region. If inserting 6 db results in the display being reduced by less than a factor of 2, the amplifier is operating in its saturated region and the sweep generator output level must be reduced.

g. Tune L406, C426, and L405 to obtain the dynamic response illustrated in figure 4-36.

h. Disconnect the equipment from the setup of figure 4-35 and, with the signal generator still tuned to 40 mc, connect the equipment as illustrated in figure 4-37.

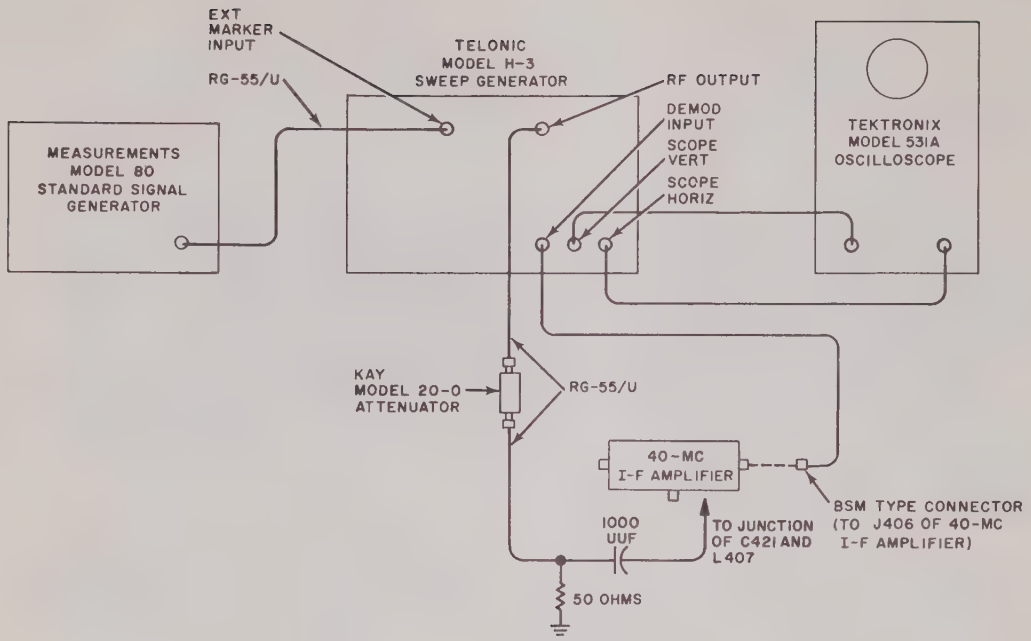


Figure 4-35. 40-Mc I-f Amplifier, Dynamic Alignment Setup (Video Section)

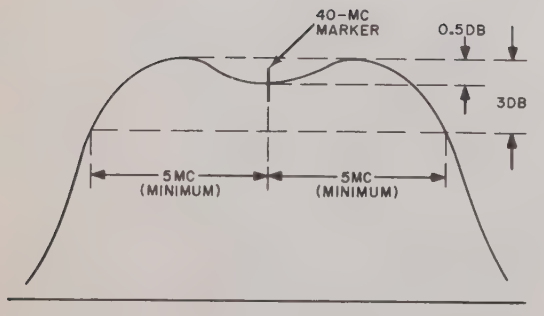


Figure 4-36. 40-Mc I-f Amplifier, Dynamic Response (Video Section)

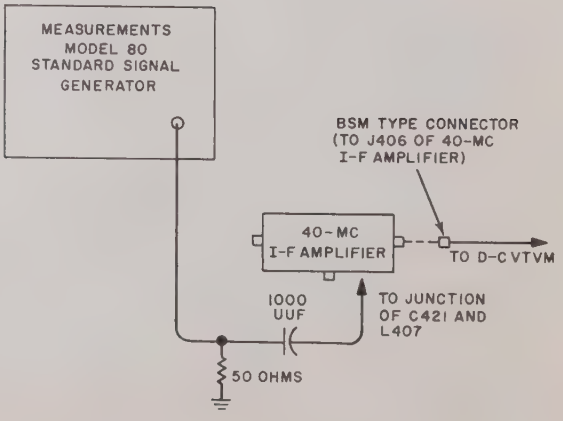


Figure 4-37. 40-Mc I-f Amplifier, Gain Measurement Setup (Video Section)

i. Adjust the signal generator output level (without exceeding calibration) to obtain a d-c vtvm indication of -5 volts. A gain of at least 6 (vtvm d-c voltage reading divided by the signal generator rms output) signifies satisfactory operation.

j. Disconnect the equipment from the setup of figure 4-36 and remove Q402 from its socket.

k. With the signal generator and sweep generator adjusted as in steps c and d, respectively, connect the equipment as illustrated in figure 4-38 and adjust the output levels of both the signal generator and sweep generator to obtain a convenient, undistorted oscilloscope display. (See note following step f.)

l. Tune L410, C421, and L407 to obtain the dynamic response illustrated in figure 4-39.

m. With the signal generator still tuned to 40 mc, connect the equipment as illustrated in figure 4-40 and adjust the signal generator output level to obtain a d-c vtvm indication of -5 volts. A gain of at least 50 (vtvm d-c reading divided by signal generator rms output) signifies satisfactory operation.

n. Disconnect the equipment from the setup of figure 4-40 and replace Q402.

o. Repeat steps c and d.

p. Connect the equipment as illustrated in figure 4-41, with the attenuator set for maximum insertion loss. Adjust both the signal generator and sweep generator output levels to obtain a convenient, undistorted oscilloscope display. (See note following step f.)

q. Tune C404 and C411 to obtain the dynamic response illustrated in figure 4-42. Note the peak level of the display at the 40-mc marker.

r. Remove the amplifier from the setup of figure 4-41 and couple the output of the attenuator directly to the detector.

s. Remove attenuation until the amplitude of the oscilloscope display (at the 40-mc marker) is equal to that of step q. Note the amount of attenuation removed. An amplifier gain of at least 24 db (represented by the amount of attenuation removed) indicates satisfactory operation.

t. Disconnect the equipment from the setup of figure 4-41 and reconnect as illustrated in figure 4-43. Adjust the output levels of both the signal generator and sweep generator to obtain a convenient oscilloscope display. (See note following step f.

u. The dynamic response should be that illustrated in figure 4-44. (Slight re-adjustment of C404, C411, L410, C421, L407, L406, C426, and/or L405 may be necessary to obtain the response of figure 4-44.)

v. Disconnect the equipment from the setup of figure 4-44 and adjust the signal generator for minimum output power at 40 mc. Reconnect the equipment as illustrated in figure 4-45.

w. Increase the signal generator output level to obtain a d-c vtvm reading of -5 volts. An overall amplifier gain of at least 830 (5 volts divided by signal generator rms output level) indicates satisfactory operation.

x. De-energize and disconnect the equipment.

y. Remove the shorts added in step a and secure the cover plate to the amplifier chassis. Replace the amplifier into the basic unit and secure the former to the basic unit mounting deck. Secure the phenolic plate to the underside of the basic unit mounting deck.

z. Connect P401, P402, and P406 to their mating receptacles and replace the tuning unit into the basic unit.

4-33. OUTPUT METER SCALE TRACKING. Repair and/or realignment of any subassembly ahead of the Output meter may necessitate retracking of the Output meter. The procedure to be employed when retracking the Output meter is indicated in the following steps. Before starting the Output meter scale tracking procedure, set the basic unit front panel controls as indicated in table 4-9.

a. With a tuning unit installed in the basic unit, energize the Model TR and allow it to warm up for at least 15 minutes.

b. Disconnect P702 (terminating video cable W7) from J702, its mating receptacle on the peak detector/metering amplifier.

c. Set the front panel Zero control fully clockwise and adjust Lin Zero control R8 to obtain a maximum Output meter indication.

d. Reset the front panel Zero control to obtain an Output meter indication of CAL.

e. Connect P702 to J702. Note that the Output meter indicates an upscale reading. Re-adjust Lin Zero control R8 to reset the Output meter indication at CAL and tighten the lock nut to secure the setting of R8.

f. Set the Scale Selector switch to LIN and connect the common probe of a d-c vtvm to TP1 (on the 40-mc i-f amplifier). Connect the positive probe of the d-c vtvm to chassis ground. Note the vtvm reading. It should be approximately 0.6 volts.

g. Rotate the IF GAIN control clockwise until the vtvm reads 5 volts greater than that of step f (approximately 5.6 volts).

h. Set Lin Adj control R13 to obtain an Output meter indication of exactly 5 on the LIN scale. Tighten the lock nut to secure the setting of R13.

i. Set the Scale Selector switch to μV and adjust the IF GAIN control to obtain a vtvm indication 1 volt greater than that of step f (approximately 1.6 volts).

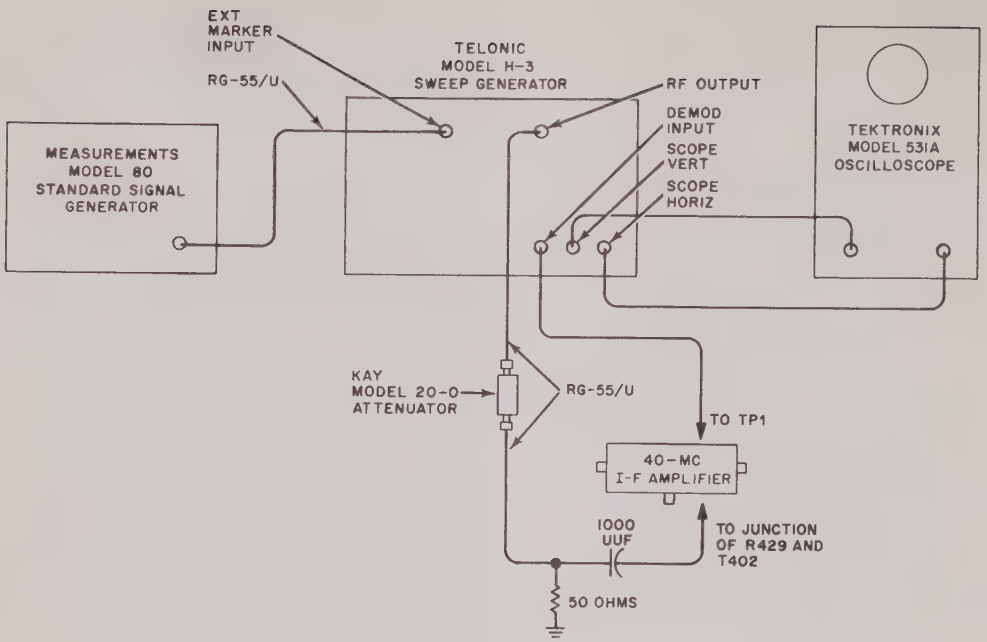


Figure 4-38. 40-Mc I-f Amplifier, Dynamic Alignment Setup (Rear Stages)

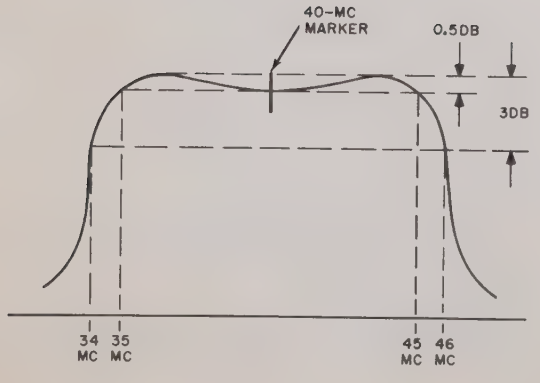


Figure 4-39. 40-Mc I-f Amplifier, Dynamic Response (Rear Stages)

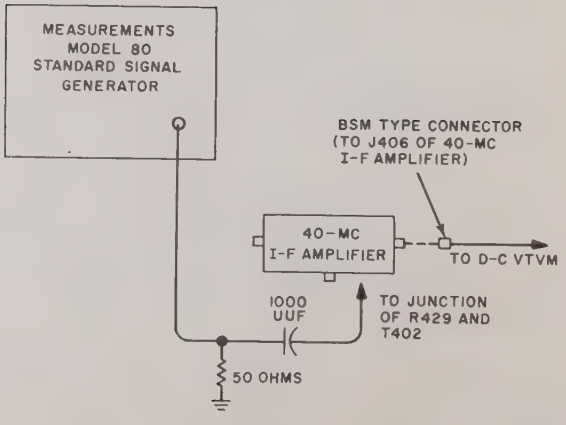


Figure 4-40. 40-Mc I-f Amplifier, Gain Measurement Setup (Rear Stages)

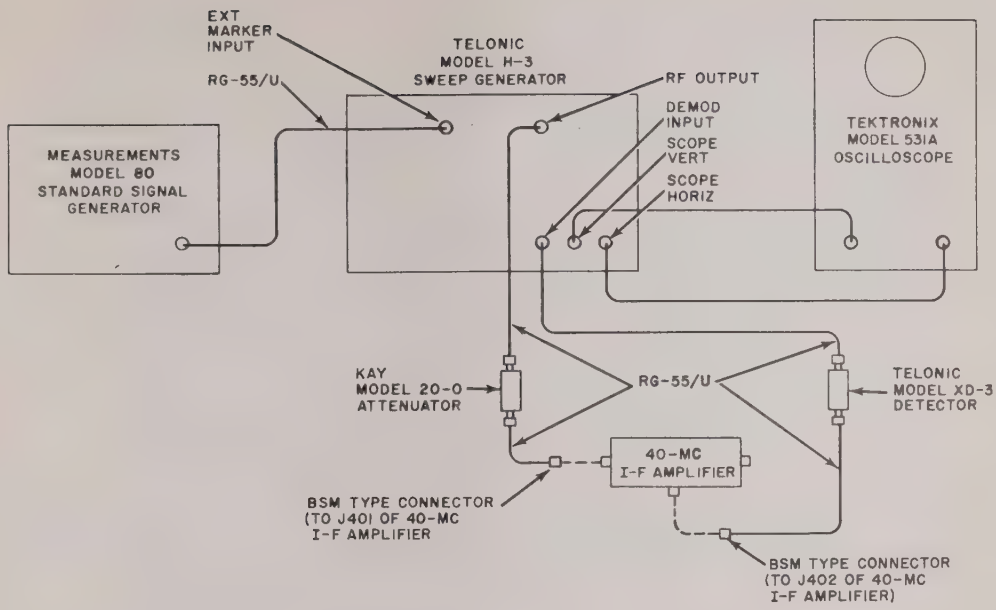


Figure 4-41. 40-Mc I-f Amplifier, Dynamic Alignment Setup (Front Stages)

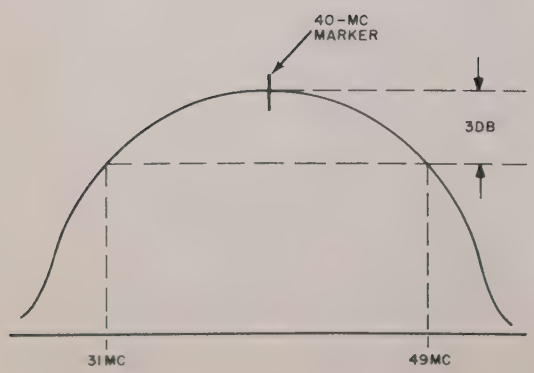


Figure 4-42. 40-Mc I-f Amplifier, Dynamic Response (Front Stages)

Note

If the vtvm reading of step i cannot be obtained, set Agc Bias Adj 1 control R713 and Agc Bias Adj 2 control R721 (both located on the peak detector/metering amplifier) to obtain the desired reading.

j. Adjust Agc Zero control R2 to obtain an Output meter indication of CAL.

k. Connect the common probe of the d-c vtvm to FL3 (on the 140/40-mc i-f amplifier); connect the positive probe to chassis ground.

l. Set Agc Bias Adj 1 control R713 to obtain a vtvm reading of 1.2 volts while maintaining an Output meter indication of CAL.

Note

The agc loop is closed when the Scale Selector switch is set to μV. Adjustment of either agc bias control will therefore cause the Output meter pointer to deflect away from the CAL indication. It will be necessary to adjust the IF GAIN control, as either agc bias control is adjusted, to maintain an Output meter indication of CAL.

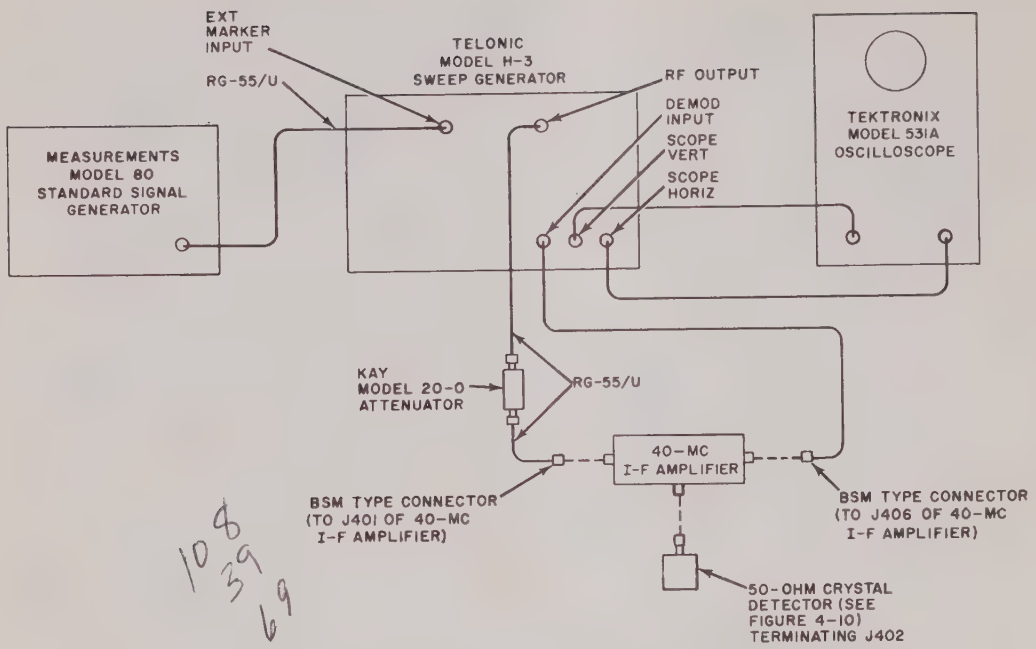


Figure 4-43. 40-Mc I-f Amplifier, Overall Dynamic Alignment Setup

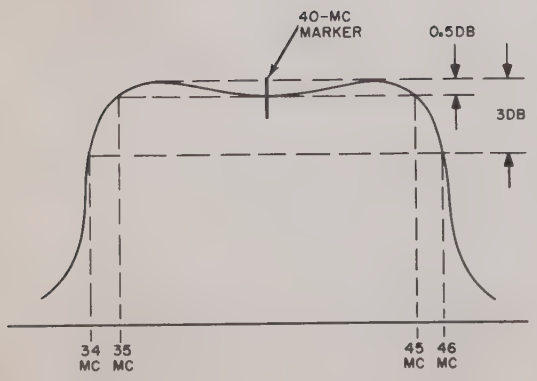


Figure 4-44. 40-Mc I-f Amplifier, Overall Dynamic Response

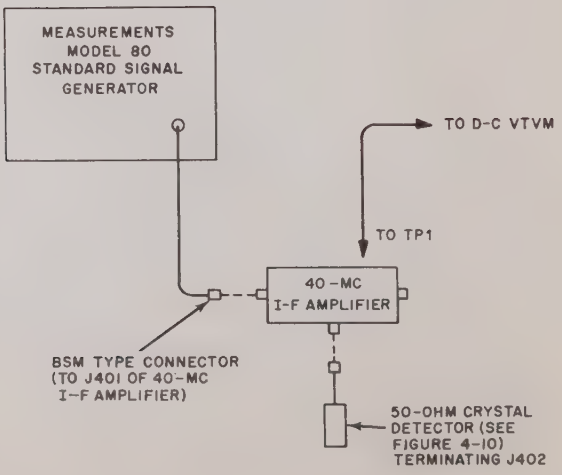


Figure 4-45. 40-Mc I-f Amplifier, Overall Gain Measurement Setup

TABLE 4-9. PRELIMINARY CONTROL SETTINGS, SCALE TRACKING

Basic Unit Control	Setting
WEIGHTING FUNCTION switch	AVG
IMPULSE BANDWIDTH-MC switch	1
Scale Selector switch	ZERO
AM FM switch	AM
AURAL AID OFF switch	OFF
AFC OFF switch	OFF
AUDIO GAIN control	Fully counterclockwise
SLIDEBACK control	Fully counterclockwise
IF GAIN control	Fully counterclockwise
POWER OFF switch	OFF

m. Connect the common probe of the d-c vtvm to FL2 (on the 140/40-mc i-f amplifier).

n. Set Agc Bias Adj 2 control R721 to obtain a vtvm reading of 0.7 volts while maintaining an Output meter indication of CAL. (Refer to the note following step l).

o. Repeat steps k through n until no further adjustment of the IF GAIN, Agc Bias Adj 1, or Agc Bias Adj 2 controls are necessary to obtain the required vtvm readings while the Output meter indication remains at CAL.

p. Set the Scale Selector switch to 70 DB and adjust the IF GAIN control to obtain an Output meter indication of CAL.

q. Connect the common probe of the d-c vtvm to TP 101 (on the 140/40-mc i-f amplifier); connect the positive probe to chassis ground. Set Scale Adj control R132 to obtain a vtvm reading of 0.50 volts.

r. Tune a standard signal generator for a cw output at 260 mc (by means of a crystal calibrator and headset) and adjust for minimum output power. Couple the signal generator to J4501, the input to the 255-mc high-pass filter.

s. Increase the signal generator output level to obtain an Output meter indication of 0 on the DB scale. Note the output level (in-dbm) required to produce this indication.

t. Increase the signal generator output level exactly 70 db above that noted in step s. Set 70 Db Adj control R11, if necessary, to obtain an Output meter indication of exactly 70 on the DB scale.

u. Reduce the signal generator output level to a minimum and then carefully increase the signal level until the Output meter indicates 0 on the DB scale. Note the signal generator output level (in -dbm). It should be approximately equal to that of step s.

v. Increase the signal generator output level exactly 40 db and note the Output meter indication on the DB scale. It should read 40 (±1).

Note

If the Output meter reading is less than 39 or greater than 41, disconnect the signal generator from J4501 and reset Scale Adj control R132 to obtain a slightly higher or lower voltage, respectively, at TP101. Proper scale tracking requires that this voltage lie within the limits of 0.45 and 0.57 volts. Repeat steps q through v until the desired indications are obtained.

w. Repeat step u and carefully increase the signal generator output level, in 10-db increments, a total of 70 db. At each 10-db step note the Output meter indication on the DB scale. The Output meter should track with an accuracy of at least ±2 db.

Note

If the tracking error is greater than ±2 db, the agc voltages must be reset (steps j through 0) to new levels. If the low end of the DB scale reads low with respect to the high end, or if the high end reads high with respect to the low end, the voltage at FL3 must be reduced slightly. If the low end of the DB scale reads high with respect to the high end, or if the high end reads low with respect to the low end, the voltage at FL2 must be reduced slightly. Reset the agc voltages, as required, until the tracking accuracy of the DB scale is within ±2 db.

x. Reduce the signal generator output to minimum value and set the Scale Selector switch to LIN.

y. Adjust the IF GAIN control to obtain an Output meter indication of 2 on the LIN scale.

z. Carefully increase the signal generator output level to obtain an Output meter indication of 2.8 on the LIN scale. Note the signal generator output level (in -dbm). This power level (which is the i-f sensitivity) should be equal to or better than -108 dbm.

aa. Readjust the signal generator for minimum output level and set the Scale Selector switch to μV. Adjust the IF GAIN control to obtain an Output meter indication of CAL.

ab. Carefully increase the signal generator output level to obtain an Output meter indication of 10 on the 1MC range of the DB ABOVE 1 μV scale. Note the signal generator output level (in -dbm) required to produce this indication.

ac. Increase the signal generator output level exactly 50 db above that noted in step ab. Set μV Adj control R12, if necessary, to obtain an Output meter indication of exactly 60 on the 1Mc range of the DB ABOVE 1 μV scale.

ad. Readjust the signal generator for minimum output level and repeat step ab.

ae. Increase the signal generator output level, in 5-db increments, a total of 50 db. At each step note the Output meter indication on the 1MC range of the DB ABOVE 1 μV scale. The Output meter should track with an accuracy of at least ±1 db.

Note

A tracking error of greater than ±1 db signifies that the agc voltages must be reset. Refer to the note following step w.

af. Without changing the operating frequency of the signal generator, couple a pulse generator to the signal generator and set the pulse generator for a repetition rate of 1,000 pps and a pulse width of 10 microseconds. Adjust the signal generator for minimum output.

ag. Set the WEIGHTING FUNCTION switch to PEAK and increase the signal generator output level to obtain an Output meter indication of 60 on the 1MC range of the DB ABOVE 1 μV scale.

ah. Connect a 600-ohm headset to the AUDIO OUTPUT connector and set the AUDIO GAIN control to obtain a comfortable aural indication.

ai. Set the WEIGHTING FUNCTION switch to SLIDEBACK and slowly rotate the SLIDEBACK control clockwise. As the 1,000-cps aural tone decreases in strength, rotate the AUDIO GAIN control further clockwise. Continue this process until the tone just vanishes.

aj. Without further adjustment of the SLIDEBACK control, set Slideback Adj control R4, if necessary, to obtain an Output meter indication of exactly 60 on the 1MC range of the DB ABOVE 1 μV scale.

ak. Reset the WEIGHTING FUNCTION switch to PEAK and reduce the signal generator output level to obtain an Output meter indication of exactly 40 on the 1MC range of the DB ABOVE 1 μV scale.

al. Reset the WEIGHTING FUNCTION switch to SLIDEBACK and rotate the SLIDEBACK control slowly counterclockwise until the 1,000-cps tone just becomes audible. Note the Output meter indication on the 1MC range of the DB ABOVE 1 μV scale. It should read 40 ± 1.

am. De-energize and disconnect the equipment. Connect P4501 to J4501.

4-34. 1-KC OSCILLATOR/AUDIO AMPLIFIER, TROUBLESHOOTING. To troubleshoot the 1-kc oscillator/audio amplifier, proceed as indicated in the following steps.

a. With operating power removed from the Model TR, check each transistor for d-c beta. Typical betas for the transistors used in the 1-kc oscillator/audio amplifier are listed in table 5-8. Replace all defective transistors.

Note

Remove one transistor at a time from the 1-kc oscillator/audio amplifier and replace it before checking the next transistor.

b. Disconnect P601 from its mating receptacle (J601).

c. Remove the two screws that secure the 1-kc oscillator/audio amplifier to the basic unit frame and carefully remove the subassembly from the basic unit.

d. Remove the four screws that secure the cover plate to the 1-kc oscillator/audio amplifier chassis and carefully remove the cover plate. The individual components that constitute the assembly will now be both visible and accessible (see figure 4-46). Visually inspect the chassis for defective components.

e. Connect a 600-ohm resistor between chassis ground and the junction of C614 and R624.

f. Connect the equipment as illustrated in figure 4-47.

g. Connect P601 to J601 and energize the Model TR.

h. Adjust the audio oscillator for a 1,000-cps output of between 0.3 and 0.4 volts rms.

i. Defects within the audio amplifier may be localized by measuring the d-c voltages at the base connectors of each transistor socket (see figure

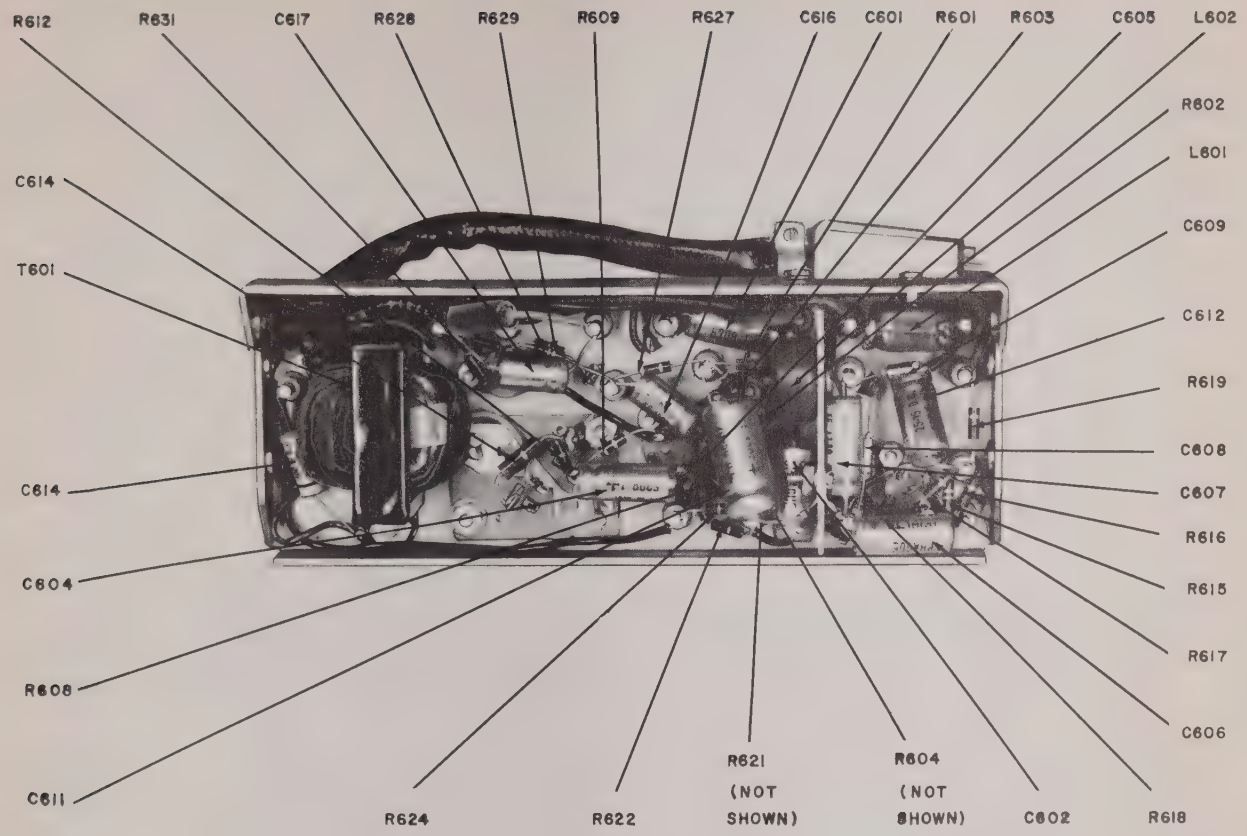


Figure 4-46. 1-Kc Oscillator/Audio Amplifier, Component Location Diagram

5-13) and by signal tracing. Refer to table 5-8 for a listing of the expected d-c voltage levels within the subassembly.

j. Set the AURAL AID OFF switch to AURAL AID and connect an oscilloscope between the emitter of Q604 and chassis ground. Normal oscillator frequency is 1,000 cps ± 20%.

k. Defects within the 1-kc oscillator may be localized by measuring the d-c voltages at the pins of XQ604. (Refer to table 5-8.)

l. De-energize and disconnect the equipment.

m. Effect the necessary repairs and/or replacements.

n. Remove the 600-ohm resistor inserted in step e and replace the cover plate. Secure the 1-kc oscillator/audio amplifier to the basic unit frame.

4-35. FM/AFC AMPLIFIER, TROUBLESHOOTING. To troubleshoot the fm/afc amplifier, proceed as directed in the following steps.

a. With the Model TR in an energized state, check the voltages (with respect to chassis ground) at C528, C532, and C533 (they should be -12 volts, -24 volts, and +6.3 volts, respectively). If proper voltages are not present, check power supplies (refer to paragraph 4-12) and inter-chassis cabling.

b. With operating power removed from the Model TR, check each transistor for d-c beta. Typical betas for the transistors used in the amplifier are listed in table 5-6. Replace all defective transistors.

Note

Remove one transistor at a time from the amplifier and replace it before checking the next transistor.

c. Perform steps c and d of paragraph 4-22.

d. Disconnect P501 and P502 from their mating receptacles (J501 and J502, respectively) and remove the four screws that secure the amplifier to the basic unit mounting deck. Carefully remove the amplifier from the basic unit.

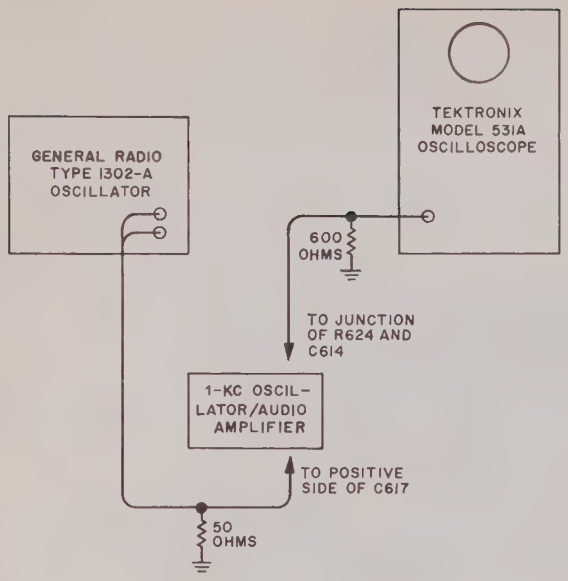


Figure 4-47. 1-Kc Oscillator/Audio Amplifier, Troubleshooting Setup (Amplifier Section)

e. Remove the six screws that secure the cover plate to the amplifier chassis and carefully remove the cover plate. The components that constitute the amplifier will now be both visible and accessible. (See figure 4-48.) Visually inspect the amplifier for defective components.

f. Set the basic unit in an upright position and connect patch cable W35 between the basic unit and a tuning unit.

g. Connect P503 to J503 and set the AFC OFF switch to OFF.

h. Tune a standard signal generator for a cw output at 40 mc (by means of a crystal calibrator and headset) and adjust the generator for a 50 millivolt output.

i. Energize the Model TR.

j. Defects within the amplifier may be localized by measuring the d-c voltage levels at the pins of each transistor socket. (Refer to figure 5-11 and table 5-6.)

k. De-energize the Model TR and effect the necessary repairs and/or replacements. Refer to paragraph 4-36 for the alignment procedure to be employed after the necessary repairs and/or replacements have been effected.

4-36. FM/AFC AMPLIFIER, ALIGNMENT. To align the fm/afc amplifier, proceed as indicated in the following steps.

a. Tune a standard signal generator for a cw output at 40 mc (by means of a crystal calibrator and headset).

b. Set a sweep generator for an output centered at 40 mc and adjust for minimum output power.

c. Connect a high impedance-low capacitance probe (see figure 4-25) between the base of Q502 and chassis ground.

d. Connect the equipment as illustrated in figure 4-49.

e. Increase the sweep generator output level and tune both L501 and C507 to obtain the dynamic response illlustrated in figure 4-50.

f. Increase the sweep generator output level until first stage limiting occurs. (Peak of dynamic response begins to flatten at approximately 1 volt.)

g. Connect the high impedance-low capacitance probe between the base of Q503 and chassis ground. Tune C514 and L504 to obtain a dynamic response of 0.1 volt peak amplitude centered at 40 mc. Remove the probe.

h. Remove the sweep generator from the setup of figure 4-49 and couple the signal generator (adjusted for a 50 millivolt output) directly to J501. Connect an r-f voltmeter between the collector of Q503 and chassis ground. Note the voltmeter indication. It should read within the limits of 0.5 and 0.6 volts rms.

i. Reconnect the equipment as illustrated in figure 4-49 and connect the high impedance-low capacitance probe between the base of Q504 and chassis ground.

j. Carefully tune C519 and both secondaries of T502 to obtain the discriminator response illustrated in figure 4-51.

k. De-energize and disconnect the equipment.

l. Replace the cover plate to the amplifier chassis and replace the amplifier into the basic unit. Secure the amplifier to the basic unit mounting deck. Connect P501 to J501.

m. Secure the phenolic plate to the underside of the basic unit mounting deck and insert an operative low-band tuning unit (Model T-RL, T-RS, or T-RM) into the basic unit.

n. Replace the basic unit into the dust cover.

o. With i-f cable assembly W13 coupling the IF output and IF input connectors, set the AFC OFF switch to OFF, the IMPULSE BANDWIDTH-MC

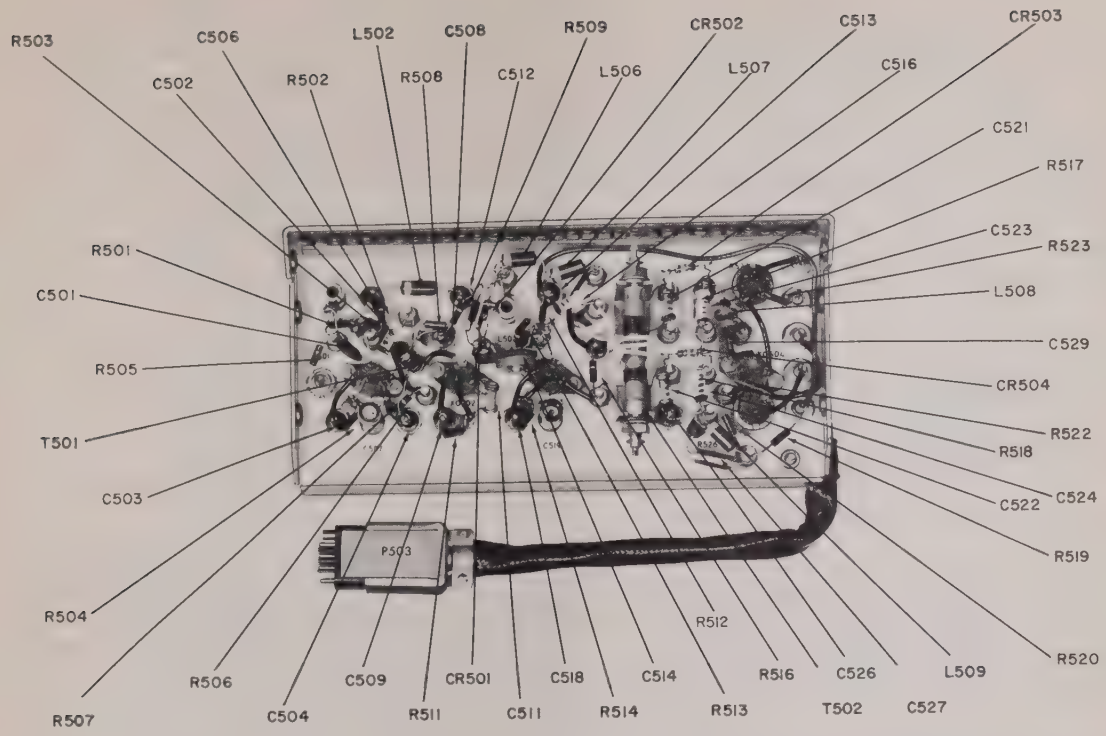


Figure 4-48. Fm/Afc Amplifier, Component Location Diagram

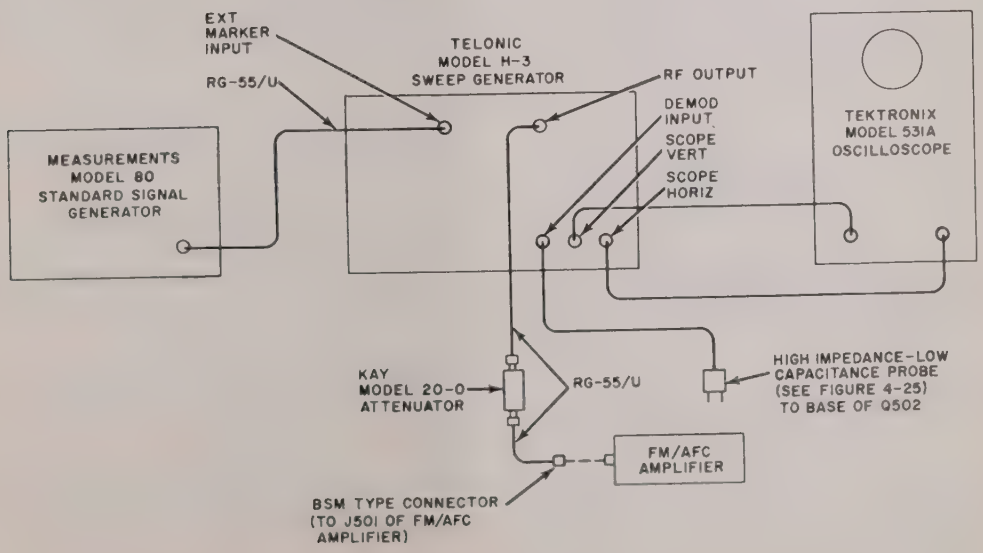


Figure 4-49. Fm/Afc Amplifier, Dynamic Alignment Setup

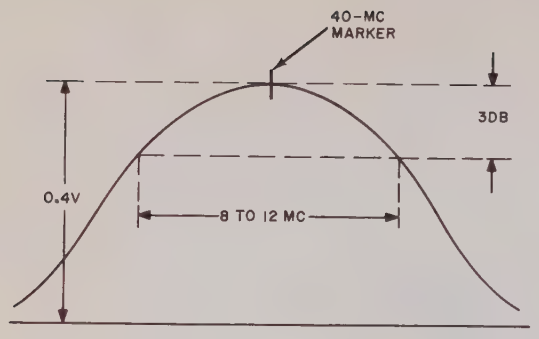


Figure 4-50. Fm/Afc Amplifier, Dynamic Response (First Stage)

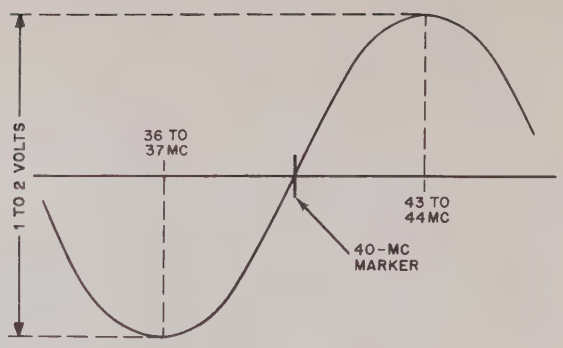


Figure 4-51. Discriminator Response

switch to 1, the WEIGHTING FUNCTION switch to AVG, and the Scale Selector switch to 70 DB.

p. Energize the Model TR and allow it to warm up.

q. Adjust the IF GAIN control to obtain an Output meter indication of CAL.

r. Set the AFC ADJUST control (on the tuning unit front panel) to mid-position.

s. Connect a microwave signal generator (tuned to any frequency within the range of the installed tuning unit) to the INPUT connector. Set the generator for a cw output.

t. Tune the Model TR to obtain a maximum Output meter indication.

u. Adjust the signal generator output level to obtain an Output meter indication of 50 on the DB scale.

v. Set the AFC OFF switch to AFC and note the Output meter indication. It should remain at 50. If it does not, Afc Adj 1 control R526 must be reset as indicated in the following additional steps.

1. Set the AFC OFF switch to OFF, carefully withdraw the basic unit approximately six inches from the dust cover, and set Afc Adj 1 control R526 fully counterclockwise.

2. Set the AFC OFF switch to AFC. If the signal "pulls out*" completely, set the AFC OFF switch to OFF and rotate Afc Adj 1 control R526 approximately 30° clockwise. Repeat the above until the condition exists where the Output meter does not indicate fully downscale. Carefully set Afc Adj 1 control R526 to obtain an Output meter indication of 50 on the DB scale.

w. De-energize the Model TR and replace the installed tuning unit with an operative Model T-RX Tuning Unit.

*Output meter pointer deflects downscale.

x. Set the AFC OFF switch to OFF and repeat steps p through u.

y. Set the AFC OFF switch to AFC and note the Output meter indication. It should remain at 50. If it does not, Afc Adj 2 control R527 must be reset as indicated in the following additional steps.

1. Set the AFC OFF switch to OFF and set Afc Adj 2 control R527 fully counterclockwise. *Output meter pointer deflects downscale.

2. Set the AFC OFF switch to AFC. If the signal "pulls out" completely, set the AFC OFF switch to OFF and rotate Afc Adj control R527 approximately 30° clockwise. Repeat the above until the condition exists where the Output meter does not indicate fully downscale. Carefully set Afc Adj 2 control R527 to obtain an Output meter indication of 50 on the DB scale.

z. De-energize and disconnect the equipment.

4-37. LOCALIZING R-F TROUBLE TO AN INDIVIDUAL SYSTEM SUBASSEMBLY.

4-38. If the results of paragraph 4-16 indicated that the cause of system malfunction lies within the r-f circuitry, proceed as directed in table 4-11 to localize the malfunction to an individual system subunit. Set the front panel controls as indicated in table 4-10.

4-39. LOW PASS FILTERS, TROUBLESHOOTING. Three low-pass filters are employed in the Model TR system; one in the output line of first mixer CR1201 (Model T-RL Tuning Unit), and one each between the INPUT connector and preselector of the Models T-RL and T-RS Tuning Units. To troubleshoot these filters, proceed as indicated in the following steps.

Note

The information contained within brackets applies to low-pass filter FL1201, and immediately follows the data applicable to filters FL1202 and FL1301.

TABLE 4-10. PRELIMINARY CONTROL SETTINGS, LOCALIZING R-F TROUBLE

Basic Unit Control	Setting
WEIGHTING FUNCTION switch	AVG
IMPULSE BANDWIDTH-MC switch	1
Scale Selector Switch	XTAL MA
AM FM switch	AM
AURAL AID OFF switch	OFF
AFC OFF switch	OFF
AUDIO GAIN control	Fully counterclockwise
SLIDEBACK control	Fully counterclockwise
IF GAIN control	Mid-position
POWER OFF switch	OFF

a. With operating power removed from the Model TR and the tuning unit withdrawn from the basic unit (refer to paragraph 4-8), disconnect the input and output connectors from the filter under test.

b. Connect a microwave signal generator [standard signal generator], tuned to any frequency within the band [tuned to 260 mc] and adjusted for a cw output level of 0 dbm [0.1 volt], to the input connector of the filter under test. Connect a thermistor mount and power meter [r-f voltmeter] to the output of the filter. Note the meter indication. An insertion loss of greater than 2 db signifies that the filter should be replaced.

4-40. FIRST MIXER, REPLACEMENT. To replace the first mixer cartridge diode, proceed as indicated in the following steps.

a. Disconnect P1205, J1308, P1403, or P1503 (depending on the tuning unit being repaired) from its mating receptacle on the first mixer crystal holder. Remove the defective cartridge diode from its seat within the holder and replace it with an operational diode, as listed in table 4-12.

b. Reconnect P1205, J1308, P1403, or P1503, as applicable, to its mating connector on the first mixer crystal holder.

4-41. FIRST LOCAL OSCILLATOR, TUBE REPLACEMENT. The reflex klystron tubes (V1201, V1301, V1401, and V1501) employed as the first local oscillators are seated at the rear of the cavity assembly (as viewed from the front of the tuning unit). The procedure for replacing the reflex klystron tube in the Models T-RL and T-RS Tuning Units is described in paragraph 4-42; that for the Models T-RM and T-RX Tuning Units is described in paragraph 4-43.

4-42. Models T-RL and T-RS Tuning Units. To replace the reflex klystron tubes in these tuning units, proceed as indicated in the following steps.

WARNING

HIGH VOLTAGES EXIST AT THE REFLEX KLYSTRON TUBE SOCKET WHEN THE MODEL TR IS ENERGIZED. BE SURE TO DE-ENERGIZE THE EQUIPMENT AND REMOVE IT FROM THE SOURCE OF OPERATING POWER BEFORE ATTEMPTING TO REPLACE THE REFLEX KLYSTRON TUBE.

a. With operating power removed from the Model TR withdraw the tuning unit from the basic unit (refer to paragraph 4-8) and loosen the clamp screw that secures the protective shield to the cavity end collar. Carefully remove the protective shield from its mounting. The knurled end collar, tube socket, and base of the reflex klystron tube will now be visible and accessible.

b. Carefully remove the tube socket from the base connectors of the reflex klystron tube.

c. Adjust spanner wrench MP1104 so that it engages two holes in the face of the end collar. Gently rotate the spanner wrench to loosen the end collar. Disengage the spanner wrench and remove the end collar from the barrel of the cavity. The base of the reflex klystron tube can now be easily grasped.

d. Grasp the protruding base of the tube and, with a clockwise twisting motion, carefully withdraw the tube from the cavity.

TABLE 4-11. R-F CIRCUITRY TROUBLESHOOTING PROCEDURE

Step	Instructions	Normal Indication	If Indication Is Abnormal	Remarks
1	Energize the Model TR and allow it to warm up at least 15 minutes. Rotate the Tuning control throughout the band and note the Output meter indication.	Output meter pointer deflects smoothly over the scale except at mode switching points in the Models T-RM and T-RX Tuning Units; approximately 6.05 gc and 9.30 gc, respectively, on the Frequency dial).	Low-pass filter FL-1201 (Model T-RL Tuning Unit only) defective. Refer to paragraph 4-39. First mixer inoperative. Refer to paragraph 4-40. First local oscillator reflector voltage improperly tracked. Refer to paragraph 4-44. First local oscillator reflex klystron inoperative. Refer to paragraph 4-41.	Check cables, probes, stubs, adapters, etc.
2	Set the Scale Selector switch to ZERO and adjust the Zero control to obtain an Output meter indication of CAL. Set the Scale Selector switch to μV and connect a microwave signal generator (programmed for a cw output of 1,000 microvolts at any frequency within the band of the tuning unit under test) to the Model TR as illustrated in figure 4-52. Tune the Model TR to the applied signal and adjust the IF GAIN control to obtain an Output meter indication of 60 on the 1 MC range of the DB ABOVE 1 μV scale.	Output meter indicates 60 on the 1 MC range of the DB ABOVE 1 μV scale.	Low-pass filter FL1202 or FL1301 (Models T-RL and T-RS Tuning Units, respectively) defective. Refer to paragraph 4-39. Preselector improperly tracked. Refer to paragraph 4-47.	Same as above.

TABLE 4-12. FIRST MIXER DIODE TYPES

Tuning Unit	First Mixer Reference Symbol Number	Crystal Type
Model T-RL	CR1201	1N21D
Model T-RS	CR1301	1N21D
Model T-RM	CR1401	1N23D
Model T-RX	CR1501	1N2510

Note

Should the toroidal spring and/or spacer washer (both contained within the cavity) come out as the reflex klystron tube is withdrawn, be sure to replace them into the cavity before inserting the replacement reflex klystron tube. The toroidal spring is to be inserted first, followed by the spacer washer.

e. Insert a replacement tube (Polarad ZV1010/7505 or equivalent for the Model T-RL Tuning Unit; Polarad ZV1009/7049 or equivalent for the Model T-RS Tuning Unit) into the cavity, applying a clockwise twisting motion to the base of the tube as it enters the cavity. A slight, but noticeable, resistance will be felt as the tube contact ring engages the toroidal spring. Continue twisting the tube, while simultaneously pressing it further into the cavity, until a positive stop is encountered. At this point the tube is properly seated within the cavity.

f. Replace the knurled end collar over the protruding base of the replacement tube and hand-tighten the collar. Firmly tighten the end collar with the spanner wrench.

CAUTION

NEVER USE FORCE WHEN MATING THE TUBE SOCKET TO THE BASE CONNECTORS OF THE REFLEX KLYSTRON TUBE. FORCED MATING OF THE TUBE SOCKET IN AN IMPROPERLY ORIENTED POSITION WILL RESULT IN THE DESTRUCTION OF THE REFLEX KLYSTRON TUBE UPON APPLICATION OF OPERATING POWER. OBSERVE THE MARKINGS ON BOTH THE SOCKET AND THE TUBE WHEN MATING THE TWO.

g. Mate the tube socket to the base connectors of the replacement tube and replace the protective shield so that the open end of the shield covers the knurled end collar. Tighten the clamp screw to secure the protective shield to the end collar.

h. Set Bias Adj control R1201 or R1301, (depending on the tuning unit being repaired) fully counterclockwise.

i. Refer to paragraph 4-44 for the reflector voltage tracking procedure to be employed after the reflex klystron has been replaced.

4-43. Models T-RM and T-RX Tuning Units. To replace the reflex klystron tubes in these tuning units, proceed as directed in steps a and b of paragraph 4-42; then continue as indicated in the following steps.

a. Adjust spanner wrench MP1104 so that it engages two holes in the face of the end collar. Gently rotate the spanner wrench to loosen the end collar. Disengage the spanner wrench and rotate the collar one or two turns by hand.

Note

Do not remove the end collar from the barrel of the cavity. The base of the reflex klystron tube protrudes far enough to permit the technician to easily grasp it.

b. Grasp the protruding base of the tube and, with a clockwise twisting motion, carefully withdraw the tube from the cavity.

c. Insert a replacement tube (Polarad ZV1011/8052 or equivalent for both the Models T-RM and T-RX Tuning Units) into the cavity, applying a clockwise twisting motion to the base of the tube as it enters the cavity. Two slight but distinct resistances will be felt as the tube contact rings engage the toroidal springs within the cavity. Continue twisting the tube, while simultaneously pressing it further into the cavity, until a positive stop is encountered. At this point the tube is properly seated within the cavity.

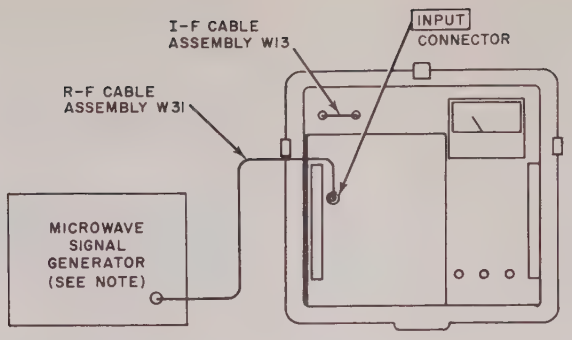
d. Replace the knurled end collar over the protruding base of the replacement tube and hand-tighten the collar. Firmly tighten the end collar with the spanner wrench.

e. Noting the caution following step f of paragraph 4-42, mate the tube socket to the base connectors of the replacement tube and replace the protective shield so that the open end of the shield covers the knurled end collar. Tighten the clamp screw to secure the protective shield to the end collar.

f. Set Bias Adj control R1301 or R1401 (depending on the tuning unit being repaired) fully counterclockwise.

g. Refer to paragraph 4-44 for the reflector voltage tracking procedure to be employed after the reflex klystron has been replaced.

4-44. FIRST LOCAL OSCILLATOR, TRACKING REFLECTOR VOLTAGE. Due to variations in the characteristics between reflex klystron tubes, the replacement of any first local oscillator tube will



Note

Polarad Model MSG-1R Microwave Signal Generator employed in conjunction with the Model T-RL Tuning Unit; Polarad Models MSG-1R and MSG-2R Microwave Signal Generators employed in conjunction with the Model T-RS Tuning Unit; Polarad Model MSG-34 Microwave Signal Generator employed in conjunction with the Model T-RM Tuning Unit; Polarad Models MSG-34 and 1709 Microwave Signal Generators employed in conjunction with the Model T-RX Tuning Unit.

Figure 4-52. R-f Circuitry Troubleshooting, Equipment Setup

necessitate retracking of the reflector voltage. The procedure for retracking the reflector voltage for the Models T-RL and T-RS Tuning Units (which do not employ mode switching) is described in paragraph 4-45; that for the Models T-RM and T-RX Tuning Units (which employ mode switching) is described in paragraph 4-46.

4-45. Models T-RL and T-RS Tuning Units. To retrack the first local oscillator reflector voltage in these tuning units, proceed as indicated in the following steps.

Note

The information contained within the brackets applies to the Model T-RS Tuning Unit, and immediately follows the data applicable to the Model T-RL Tuning Unit.

a. With the Model TR installed in its dust cover and with operating power removed from the equipment, remove the tuning unit from the basic unit (refer to paragraph 4-8) and connect patch cable W35 between the basic unit and tuning unit.

b. To insure proper air flow within the equipment, tape a 9" x 11" sheet of cardboard (having a small cutout for the patch cable) over the basic unit front panel opening created by the removal of the tuning unit.

c. Replace the first mixer cartridge diode (refer to paragraph 4-40) from its housing and replace it with a dummy diode; one that has been purposely shorted by the removal of its detecting element and its casing filled with solder.

d. Connect a length of RG-55/U coaxial cable between J1205 [P1308] and the input connector of a frequency meter, as illustrated in figure 4-53.

e. Connect a crystal detector (one having a d-c return) between the output connector of the frequency meter and the vertical input terminals of an oscilloscope, as illustrated in figure 4-53.

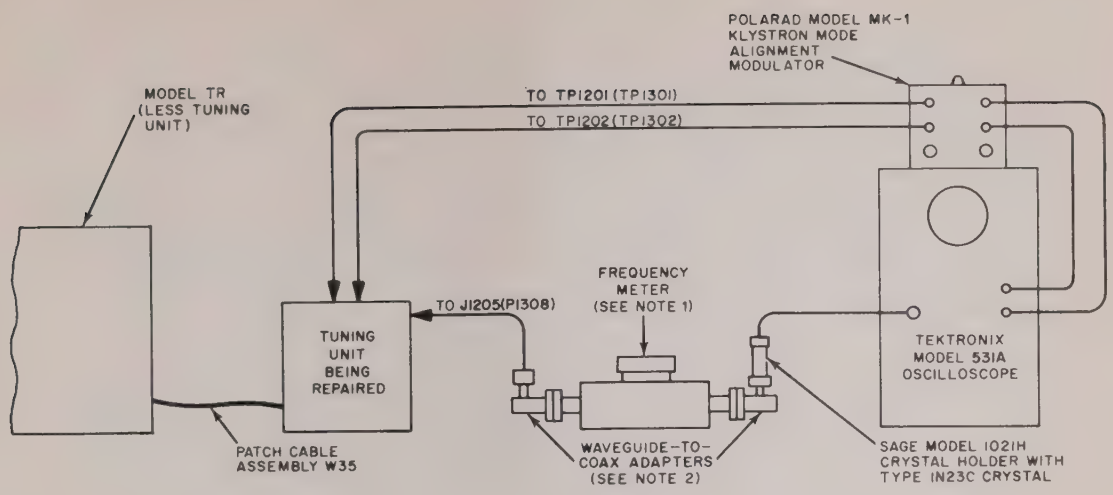
f. Connect the "reflector" terminals of a Polarad Model MK-1 Klystron Mode Alignment Modulator between TP1201 [TP1301] and TP1202 [TP1302], as illustrated in figure 4-53. Connect the "h scope" and "gnd" terminals of the modulator to the horizontal input terminals of the oscilloscope. (If the Model MK-1 Klystron Mode Alignment Modulator is not available, an equivalent unit can be constructed with the aid of the schematic diagram supplied in figure 4-54.)

g. Remove the protective phenolic plate covering TB1203 [TB1303] and connect the positive probe of a d-c voltmeter to pin 3. Connect the common probe of the voltmeter to TP1202 [TP1302].

h. Connect a d-c vtvm across R1230 [R1330].

i. Set the AFC OFF switch to OFF and energize the Model TR. Allow the equipment to warm up for at least 15 minutes.

j. Set Bias Adj control R1201 [R1301] to obtain a vtvm indication of 1.0 volt [1.0 volt]. Remove the vtvm.



Notes
1. PRD Model 587-A Frequency Meter and FXR Model N410A Frequency Meter employed in conjunction with the Model T-RL Tuning Unit; FXR Models N410A and H410A Frequency Meters employed in conjunction with the Model T-RS Tuning Unit.
2. FXR Models H601B Waveguide-to-Coax Adapters used with the Model H410A Frequency Meter.

Figure 4-53. Reflector Voltage Tracking, Equipment Setup (Models T-RL and T-RS Tuning Units)

k. Rotate the Tuning control to position the first local oscillator cam follower at the fixed point of the adjustable-periphery tuning cam (see figure 4-55). The Frequency indicator should read approximately 1.550 gc [3.225 gc] .

l. Adjust the "amp" control of the modulator to obtain a mode display similar to that illustrated in figure 4-56a. If the mode display of figure 4-56a is not centered on the oscilloscope screen, as illustrated in figure 4-56b, or does not appear at all, proceed as directed in the following additional steps.

1. Rotate the Tuning control to obtain a Frequency indicator reading corresponding to the high end of the band and set High Adj control R1207 [R1307] to center the mode on the oscilloscope screen. Note the voltmeter indication. A reading within the limits of -215 and -275 volts [-280 and -360 volts] signifies that the reflex klystron is oscillating in the desired 2 3/4-wave reflector mode [2 3/4-wave reflector mode] . (See figure 4-57 [figure 4-58] .)

2. Adjust the modulator "phase" control to superimpose the two traces so that they appear as a single trace, as illustrated in figure 4-56c.

3. Rotate the Tuning control to obtain a Frequency indicator reading corresponding to the low end of the band and set Low Adj control R1204 [R1304] to center the mode on the oscilloscope screen. Note the voltmeter indication. A reading within the limits of -40 and -75 volts [-5 and -40 volts] signifies that the reflex klystron is oscillating in the desired 2 3/4-wave reflector mode [2 3/4-wave reflector mode] . (See figure 4-57 [figure 4-58] .)

4. Due to interaction between High Adj control R1207 [R1307] and Low Adj control R1204 [R1304], it will be necessary to repeat the above steps for optimum setting of the reflector voltage.

m. Adjust the "phase" control of the modulator to superimpose the two traces so that they appear as a single trace, as illustrated in figure 4-56c.

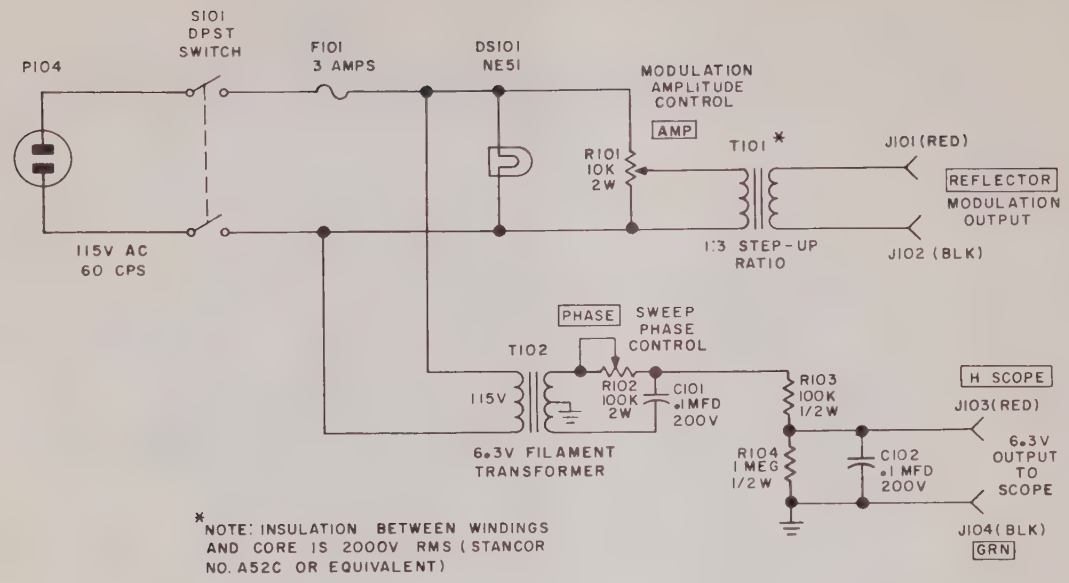


Figure 4-54. Klystron Mode Alignment Modulator, Schematic Diagram

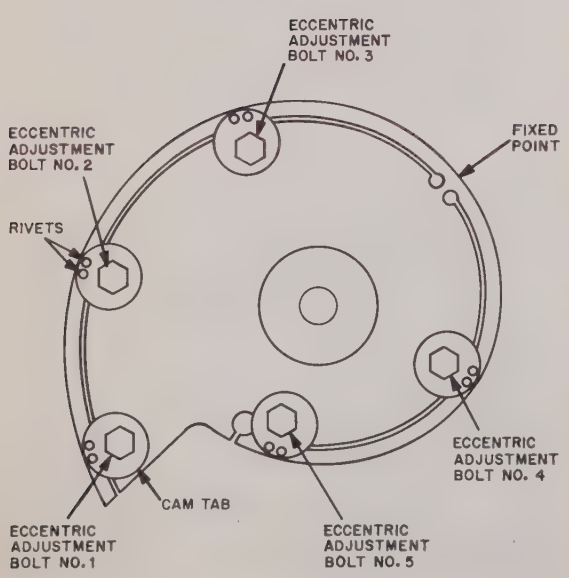


Figure 4-55. Typical Adjustable-Periphery Tuning Cam

n. Rotate the Tuning control throughout the band and note the mode pattern displayed on the oscilloscope screen. The mode pattern should be continuous, remain centered on the oscilloscope screen, and display no splitting at any point.

Note

Should the mode be erratic at any point within the band, rotate the Tuning control to the point of discontinuity and remove operating power from the Model TR. Remove the protective shield from the end collar and loosen the latter with the spanner wrench. Gently twist the base of the tube clockwise, tighten the end collar, and replace the protective shield. Rescan the band for discontinuities as directed in step n.

Since the proper orientation of the reflex klystron tube within the cavity cannot be anticipated for optimum operation, it is suggested that the twisting procedure be performed in 30° increments until continuity throughout the band is achieved.

o. Rotate the Tuning control to position the first local oscillator cam follower at the fixed point of the adjustable periphery tuning cam. (See figure 4-55.) Note the Frequency indicator reading. Tune the frequency meter to 260 mc above [260 mc above] the Frequency indicator reading.

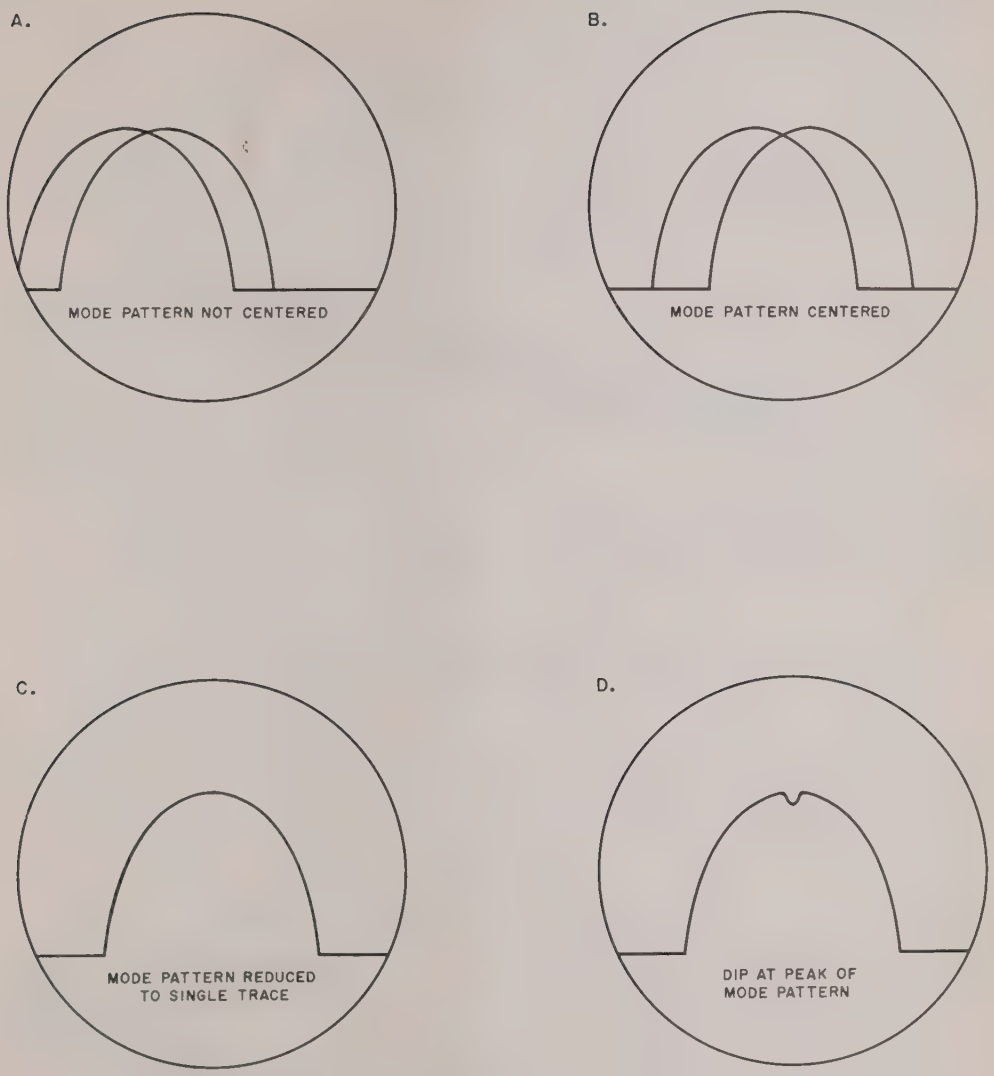


Figure 4-56. Typical Mode Pattern Displays

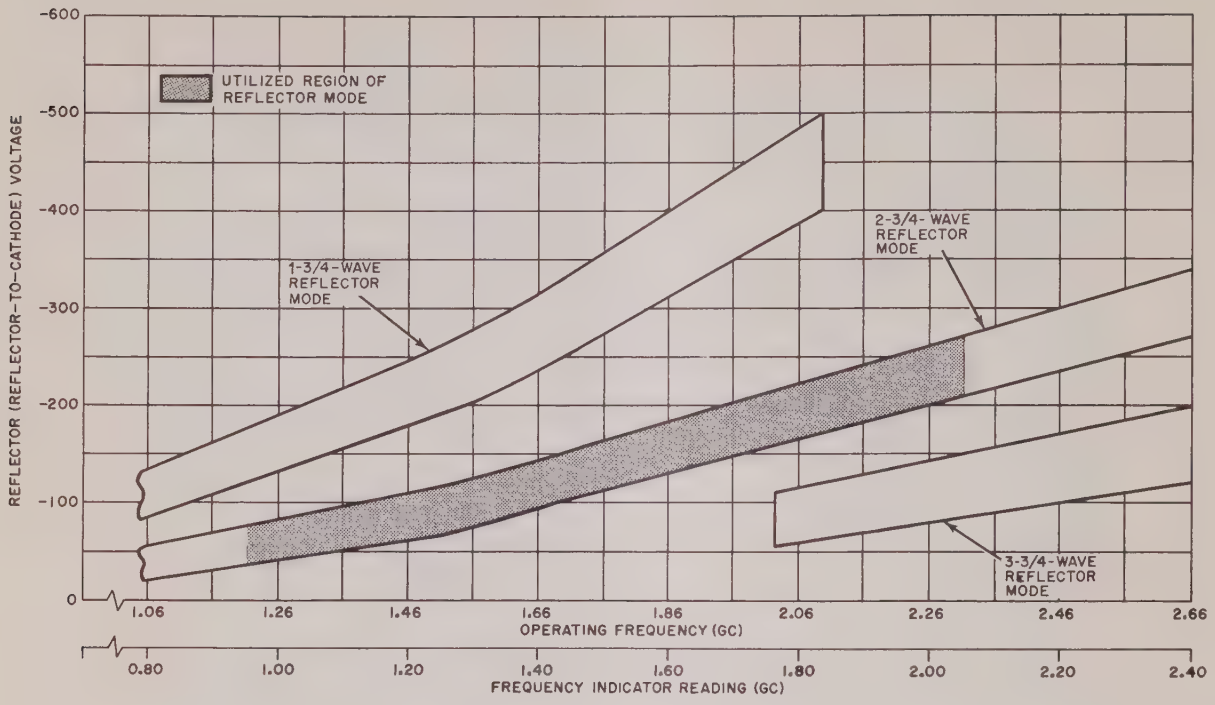


Figure 4-57. Typical Reflector Voltage Vs Frequency Characteristics, First Local Oscillator V1201 (ZV1010/7505)

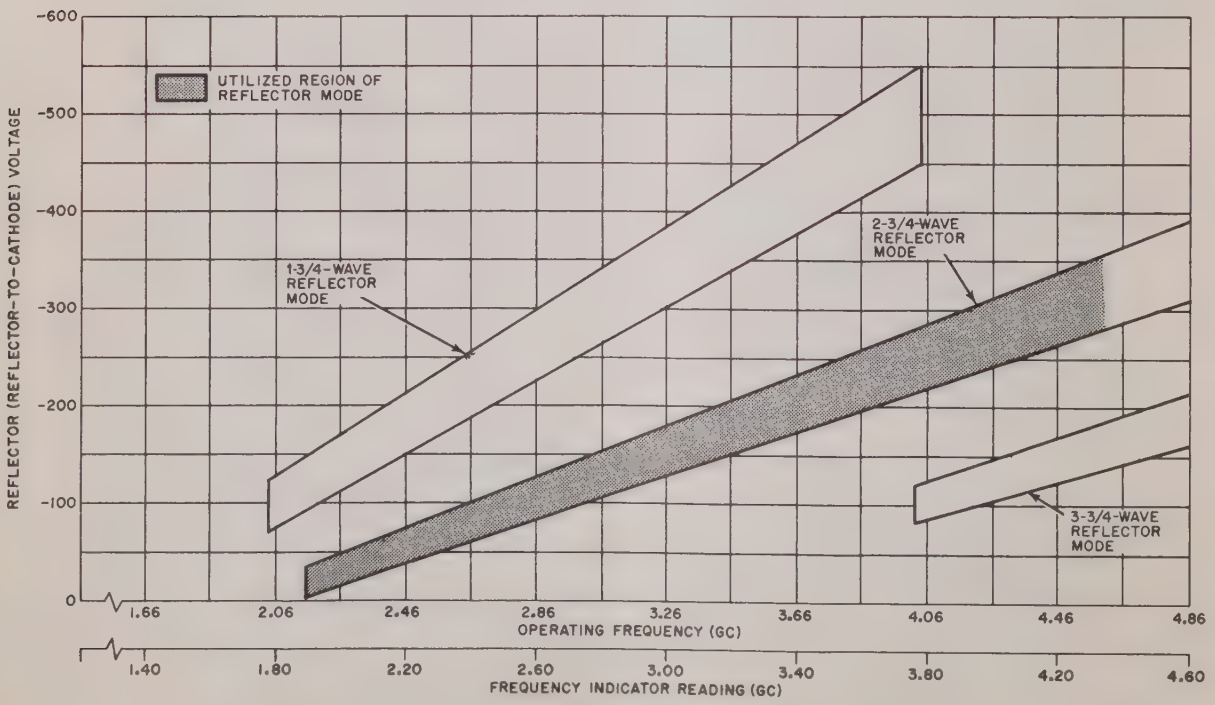


Figure 4-58. Typical Reflector Voltage Vs Frequency Characteristics, First Local Oscillator V1301 (ZV1009/7049)

p. Loosen the setscrew that secures the setting of the cavity coarse tuning adjustment screw. Carefully adjust the setting of this screw to obtain a dip at the peak of the displayed mode, as illustrated in figure 4-56d. Fix the setting of the screw by tightening the stescrew.

q. Rotate the Tuning control so that the first local oscillator cam follower rests opposite eccentric adjustment bolt no. 1 of the adjustable-periphery tuning cam. (See figure 4-55.) Note the Frequency indicator reading. Tune the frequency meter to obtain a dip at the peak of the displayed mode, as illustrated in figure 4-56d. Note the frequency meter reading. The frequency meter reading less 260 mc [less 260 mc] should be within ± 1% of the Frequency indicator reading.

r. Repeat step q for the first local oscillator cam follower resting opposite eccentric adjustment bolts no. 2, 3, 4, and 5, in sequence. The frequency meter reading less 260 mc, should be within ± 1% of the Frequency indicator reading at each point. If the specified tolerance is not achieved at all test points, proceed as directed in the following additional steps.

CAUTION

NEVER ATTEMPT TO ADJUST ANY TAB ON THE ADJUSTABLE-PERIPHERY TUNING CAM UNLESS ALL ADJUSTMENT BOLTS ON THAT SECTION OF THE CAM HAVE FIRST BEEN LOOSENED. FAILURE TO OBSERVE THIS PRECAUTION WILL RESULT IN SHEARING THE RIVETS THAT SECURE THE TABS TO THE ADJUSTABLE PERIPHERY OF THE CAM.

Note

If the error occurs at the high end of the band, loosen, in the order stated, eccentric adjustment bolts no. 1, 2, and 3. If the error is at the low end of the band, loosen, in the order stated, eccentric adjustment bolts no. 4 and 5.

1. Rotate the Tuning control to position the first local oscillator cam follower opposite the eccentric adjustment bolt closest to the fixed point of the cam. Note the Frequency indicator reading.

2. Tune the frequency meter to 260 mc above that of the Frequency indicator and adjust the position of the cam tab so that the dip appears at the peak of the mode, as illustrated in figure 4-56d. Tighten the eccentric adjustment bolt in this position.

3. Repeat steps 1 and 2 for the remaining eccentric adjustment bolts on that side of the fixed point.

s. De-energize the equipment and disconnect from the setup of figure 4-53.

t. Replace the dummy crystal mixer installed in step c with an operative diode.

u. Re-energize the Model TR.

v. Set the Scale Selector switch to XTAL MA and rotate the Tuning control throughout the band. Note the Output meter indication on the XTAL MA scale. The minimum value of crystal current should not be less than 0.2 ma at any point within the band.

w. De-energize the Model TR and replace the protective phenolic plate over TB1203 [TB1303]. Retracking the first local oscillator reflector voltage will necessitate retracking the preselector. Refer to paragraph 4-47.

4-46. Models T-RM and T-RX Tuning Units. To retrack the first local oscillator reflector voltage in these tuning units, proceed as directed in steps a through c of paragraph 4-45; then continue as indicated in the following steps.

Note

The information contained within the brackets applies to the Model T-RX Tuning Unit, and immediately follows the data applicable to the Model T-RM Tuning Unit.

a. Connect a length of RG-55/U coaxial cable between J1403 [J1503] and the input connector of a frequency meter, as illustrated in figure 4-59.

b. Connect a crystal detector (one having a d-c return) between the output connector of the frequency meter and the vertical input terminals of an oscilloscope, as illustrated in figure 4-59.

c. Connect the "reflector" terminals of a Polarad Model MK-1 Klystron Mode Alignment Modulator (refer to note after step f of paragraph 4-45) between TP1401 [TP1501] and TP1402 [TP1502], as illustrated in figure 4-59. Connect the "h scope" and "gnd" terminals of the modulator to the horizontal input terminals of the oscilloscope.

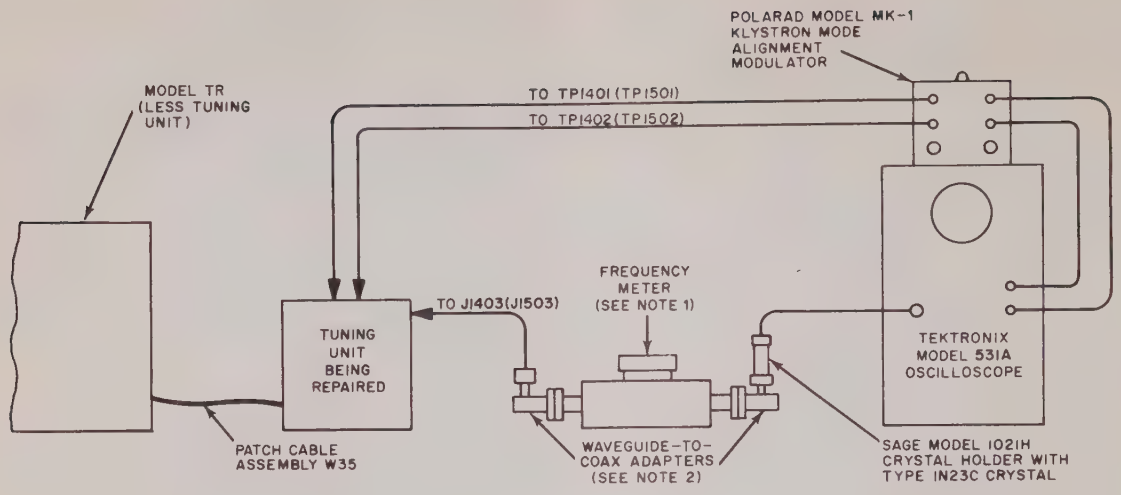
d. Remove the protective phenolic plate covering TB1403 [TB1503] and connect the positive probe of a d-c voltmeter to pin 3. Connect the common probe of the d-c voltmeter to TP1402 [TP1502].

e. Connect a d-c vtvm across R1430 [R1530].

f. Set the AFC OFF switch to OFF and energize the Model TR. Allow the equipment to warm up for at least 15 minutes.

g. Set Bias Adj control R1401 [R1501] to obtain a vtvm indication of 0.8 volts [0.8 volts]. Remove the vtvm.

h. Rotate the Tuning control to position the first local oscillator cam follower at the fixed point of the



Notes
1. FXR Models H410A and C410A Frequency Meters employed in conjunction with the Model T-RM Tuning Unit; FXR Models C410A and X410A Frequency Meters employed in conjunction with the Model T-RX Tuning Unit.
2. FXR Models H601B Waveguide-to-Coax Adapters used with the Model H410A Frequency Meter; FXR Models C601B Waveguide-to-Coax Adapters used with the Model C410A Frequency Meter; FXR Models X601B Waveguide-to-Coax Adapters used with the Model X410A Frequency Meter.

Figure 4-59. Reflector Voltage Tracking, Equipment Setup (Models T-RM and T-RX Tuning Units)

adjustable-periphery tuning cam (see figure 4-55). The Frequency indicator should read approximately 6.180 gc [9.500 gc].

i. Adjust the "amp" control of the modulator to obtain a mode display similar to that illustrated in figure 4-56a.

Note

If the mode display of figure 4-56a is not centered on the oscilloscope screen, as illustrated in figure 4-56b, or does not appear at all, proceed as directed in the following additional steps.

1. Rotate the Tuning control to obtain a Frequency indicator reading corresponding to the high end of the band and set High Adj control R1406 [R1506] to center the mode on the oscilloscope screen. Note the voltmeter indication. A reading within the limits of -200 and -275 volts [-230 and -350 volts] signifies that the reflex klystron is oscillating in the desired 3 3/4-wave reflector mode [4 3/4-wave reflector mode]. (See figure 4-60 [figure 4-61].)

2. Adjust the modulator "phase" control to superimpose the two traces so that they appear as a single trace, as illustrated in figure 4-56c.

3. Rotate the Tuning control to obtain a Frequency indicator reading of 6.15 gc [9.40 gc], a frequency slightly above the mode switching point. Set Track 2 control R1409 [R1509] to center the mode pattern on the oscilloscope screen and note the voltmeter indication. A reading within the limits of -75 and -125 volts [-130 and -210 volts] signifies that the reflex klystron is oscillating in the desired 3 3/4-wave reflector mode [4 3/4-wave reflector mode]. (See figure 4-60 [figure 4-61].)

4. Due to interaction between High Adj control R1406 [R1506] and Track 2 control R1409 [R1509], it will be necessary to repeat steps 1 through 3 for optimum setting of the reflector voltage.

5. Rotate the Tuning control to obtain a Frequency indicator reading corresponding to the low end of the band and set Low Adj control R1404 [R1504] to center the mode pattern on the oscilloscope screen. Note the voltmeter indication. A

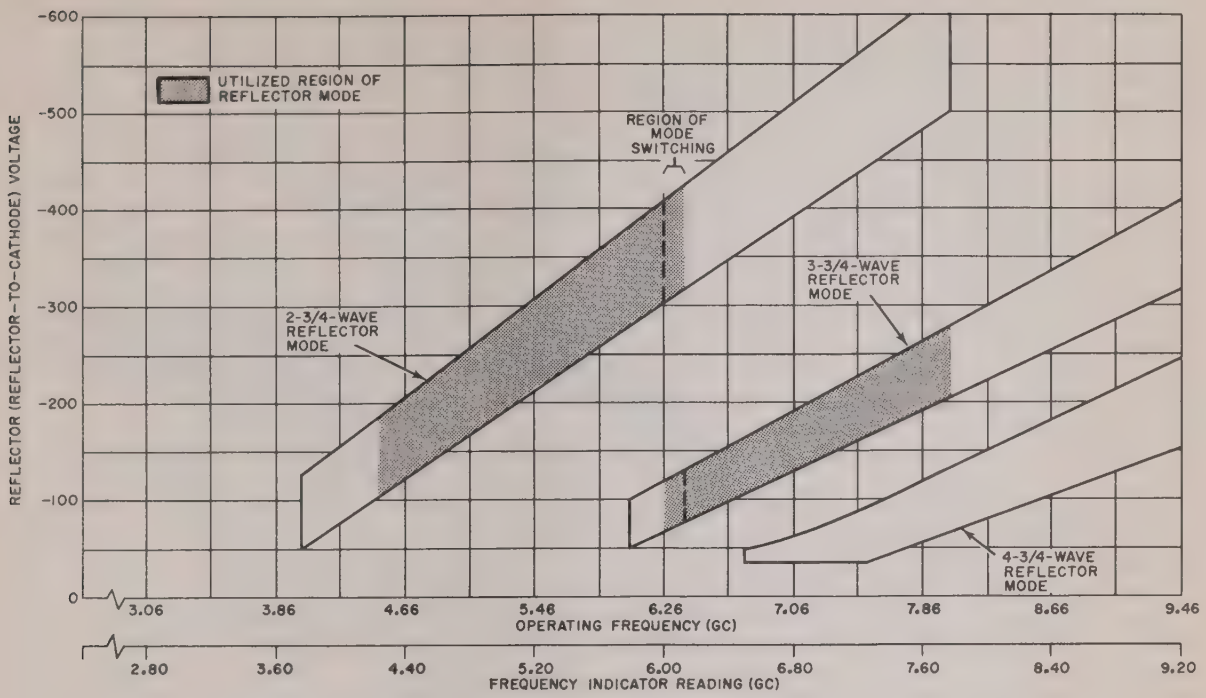


Figure 4-60. Typical Reflector Voltage Vs Frequency Characteristics, First Local Oscillator V1401 (ZV1011/8052)

reading within the limits of -100 and -180 volts [-130 and -190 volts] signifies that the reflex klystron is oscillating in the desired 2 3/4-wave reflector mode [3 3/4-wave reflector mode]. (See figure 4-60 [figure 4-61].)

6. Rotate the Tuning control to obtain a Frequency indicator reading of 5.95 gc [9.20 gc], a frequency slightly below the mode switching point. Set Track 1 control R1407 [R1507] to center the mode pattern on the oscilloscope screen. Note the voltmeter indication. A reading within the limits of -300 and -400 volts [-270 and -350 volts] signifies that the reflex klystron is oscillating in the desired 2 3/4-wave reflector mode [3 3/4-wave reflector mode]. (See figure 4-60 [figure 4-61].)

7. Due to interaction between Low Adj control R1404 [R1504] and Track 1 control R1407 [R1507], it will be necessary to repeat steps 5 and 6 for optimum setting of the reflector voltage.

j. Adjust the "phase" control of the modulator to superimpose the two traces so that they appear as a single trace, as illustrated in figure 4-56c.

k. Rotate the Tuning control throughout the band and note the mode pattern displayed on the oscilloscope screen. The mode pattern should be continuous, remain centered on the oscilloscope screen, and display no splitting at any point. (See note following step n of paragraph 4-45.

l. Rotate the Tuning control to position the first local oscillator cam follower at the fixed point of the adjustable-periphery tuning cam. (See figure 4-55.) Note the Frequency indicator reading. Tune the frequency meter to 260 mc above [260 mc below] the Frequency indicator reading.

m. Loosen the setscrew that secures the setting of the cavity coarse tuning adjustment screw. Carefully adjust the setting of this screw to obtain a dip at the peak of the displayed mode, as illustrated in figure 4-56d. Fix the setting of the screw by tightening the setscrew.

n. Rotate the Tuning control so that the first local oscillator cam follower rests opposite eccentric adjustment bolt no. 1 of the adjustable-periphery tuning cam. (See figure 4-55.) Tune the frequency meter to obtain a dip at the peak of the displayed mode, as illustrated in figure 4-56d. Note the frequency meter reading. The frequency meter reading less 260 mc [plus 260 mc] should be within ± 1% of the Frequency indicator reading.

o. Repeat step n for the first local oscillator cam follower resting opposite eccentric adjustment bolts no. 2, 3, 4, and 5, in sequence. The frequency

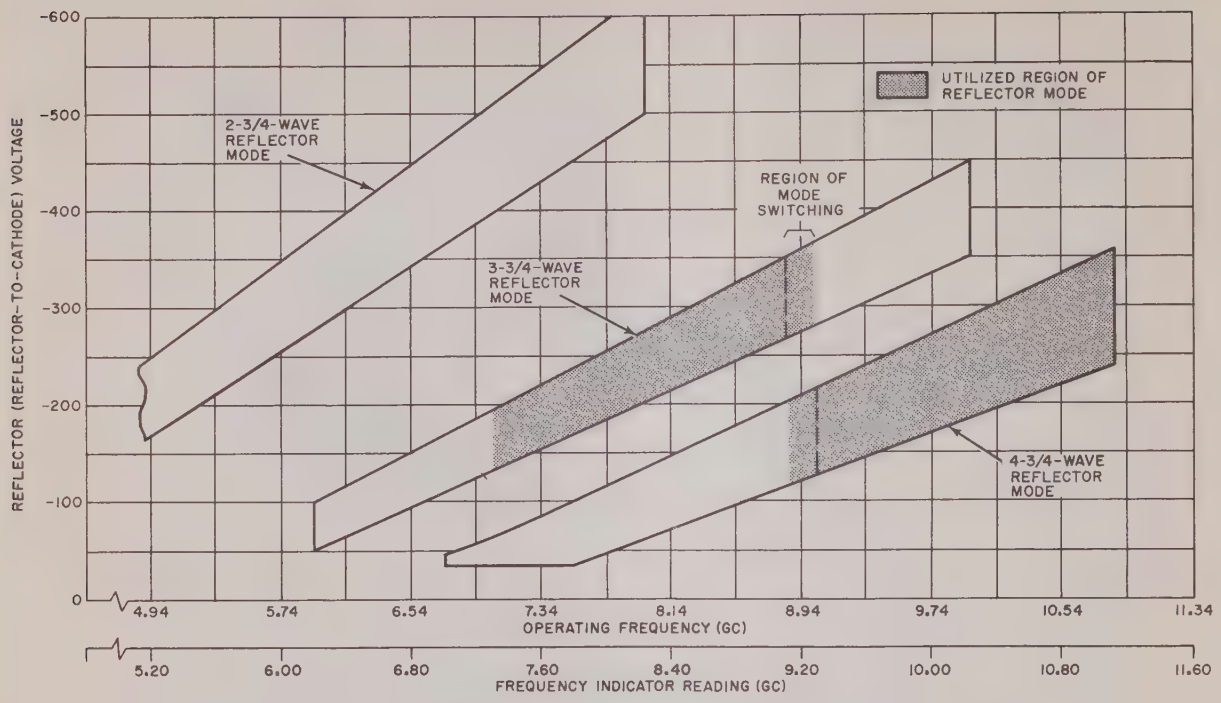


Figure 4-61. Typical Reflector Voltage Vs Frequency Characteristics, First Local Oscillator V1501 (ZV1011/8052)

meter reading less 260 mc [plus 260 mc] should be within ± 1% of the Frequency indicator reading. If the specified tolerance is not achieved at all test points, proceed as directed in the following additional steps.

CAUTION

NEVER ATTEMPT TO ADJUST ANY TAB ON THE ADJUSTABLE-PERIPHERY TUNING CAM UNLESS ALL ADJUSTMENT BOLTS ON THAT SECTION OF THE CAM HAVE FIRST BEEN LOOSENED. FAILURE TO OBSERVE THIS PRECAUTION WILL RESULT IN SHEARING THE RIVETS THAT SECURE THE TABS TO THE ADJUSTABLE PERIPHERY OF THE CAM.

Note

If the error occurs at the high end of the band, loosen, in the order stated, eccentric adjustment bolts no. 1, 2, and 3. If the error is at the low end of the band, loosen, in the order stated, eccentric adjustment bolts no. 4 and 5.

1. Rotate the Tuning control to position the first local oscillator cam follower opposite the eccentric adjustment bolt closest to the fixed point of the cam. Note the Frequency indicator reading.

2. Tune the frequency meter to 260 mc above [260 mc below] that of the Frequency indicator and adjust the position of the cam tab so that the dip appears at the peak of the mode, as illustrated in figure 4-56d. Tighten the eccentric adjustment bolt in this position.

3. Repeat steps 1 and 2 for the remaining eccentric adjustment bolts on that side of the fixed point.

p. De-ernegize the equipment and disconnect from the setup of figure 4-59.

q. Replace the dummy crystal mixer with an operative diode.

r. Re-energize the Model TR and allow the delay period to transpire.

s. Set the Scale Selector switch to XTAL MA and rotate the Tuning control throughout the band. Note the Output meter indication on the XTAL MA scale. The minimum value of crystal current should not be less than 0.2 ma at any point within the band.

t. De-energize the Model TR and replace the protective phenolic plate over TB1403 [TB1503]. Retracking the first local oscillator reflector voltage will necessitate retracking the preselector. Refer to paragraph 4-47.

4-47. PRESELECTOR, RETRACKING. Replacement of the first local oscillator reflex klystron tube and/or retracking of its reflector voltage will necessitate retracking of the tuning unit preselector. The procedure for tracking these preselectors is contained in the following steps.

a. With operating power removed from the Model TR and the equipment installed in its dust cover, remove the tuning unit from the basic unit and connect patch cable W35 between the two.

b. To insure proper air flow within the equipment, tape a 9" x 11" sheet of cardboard (with a small cut-out for the patch cable) over the basic unit front panel opening created by the removal of the tuning unit.

c. Set the front panel controls as indicated in table 4-13.

d. Energize the Model TR and allow the equipment to warm up for at least 15 minutes.

e. Rotate the Tuning control to obtain a Frequency dial indication corresponding to the high end of the band.

f. Adjust the IF GAIN control to obtain an Output meter indication of 1 on the LIN scale.

g. Program a microwave signal generator for a cw output of approximately -60 dbm at the frequency read on the Frequency indicator and connect the equipment as illustrated in figure 4-62.

h. Adjust each of the preselector coarse tuning adjustment screws to obtain a maximum Output meter indication.

Note

It will be necessary to reduce the signal generator output level if the Output meter pointer deflects to an off-scale indication.

i. Rotate the Tuning control to obtain a Frequency indicator reading corresponding to the low end of the band and tune the signal generator to this frequency.

j. Adjust the fine tuning adjustment screws nearest the two preselector indicators to obtain a maximum indication on the Output meter.

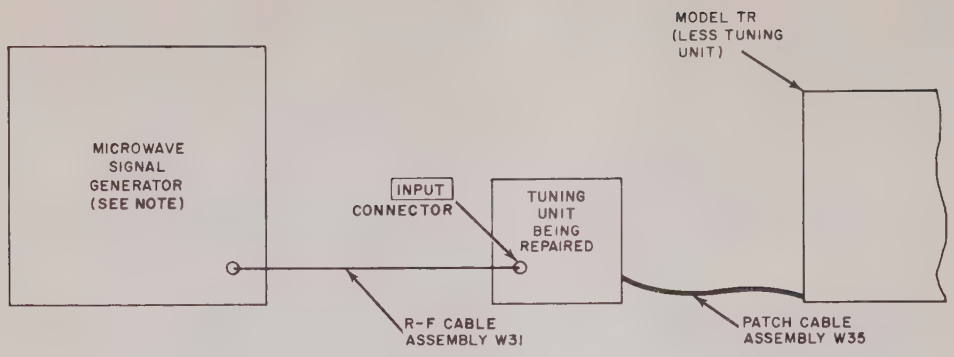
k. Rotate the Tuning control clockwise until a set of fine tuning adjustment screws is positioned directly beneath the two preselector indicators. Tune the signal generator to the frequency read on the Frequency indicator and adjust the set of fine tuning adjustment screws beneath the preselector indicators to obtain a maximum indication on the Output meter.

l. Repeat step k for the remaining sets of fine tuning adjustment screws.

m. After the preselector has been aligned, de-energize the Model TR and determine the system sensitivity at various points within the band (refer to step 4 of table 4-4). If the sensitivity is low, re-adjustment of the preselector fine tuning adjustment screws will be necessary.

TABLE 4-13. PRELIMINARY CONTROL SETTINGS, PRESELECTOR TRACKING

Front Panel Control	Setting
WEIGHTING FUNCTION switch	AVG
IMPULSE BANDWIDTH-MC switch	1
Scale Selector switch	LIN
AM FM switch	AM
AURAL AID OFF switch	OFF
AUDIO GAIN control	Fully counterclockwise
SLIDEBACK control	Fully counterclockwise
IF GAIN control	Mid-position
POWER OFF switch	OFF



Note

Polarad Model MSG-1R Microwave Signal Generator employed in conjunction with the Model T-RL Tuning Unit; Polarad Models MSG-1R and MSG-2R Microwave Signal Generators employed in conjunction with the Model T-RS Tuning Unit; Polarad Model MSG-34 Microwave Signal Generator employed in conjunction with the Model T-RM Tuning Unit; Polarad Models MSG-34 and 1709 Microwave Signal Generators employed in conjunction with the Model T-RX Tuning Unit.

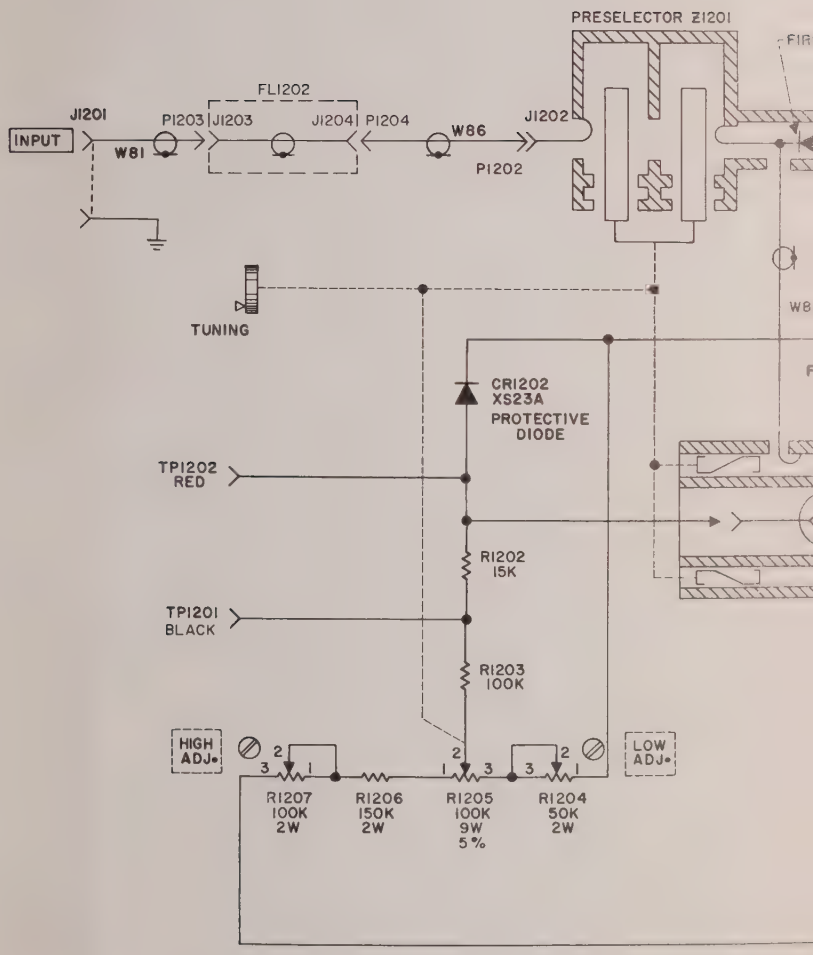
Figure 4-62. Preselector Tracking, Equipment Setup

SECTION V

SCHEMATIC DIAGRAMS

5-1. GENERAL.

5-2. This section contains the schematic diagrams and voltage measurements that are essential aids in the maintenance of the Model TR system. The diagrams are to be employed in conjunction with Section III to help the technician understand the operation of the Model TR. Both the diagrams and the voltage measurements are to be used in conjunction with Section IV to facilitate troubleshooting and maintenance operations.


PRESELECTOR Z1201
FIR
FL1202
J1201
INPUT
W81
P1203
J1203
J1204
P1204
W86
J1202
P1202
W8
TUNING
CR1202
XS23A
PROTECTIVE
DIODE
TP1202
RED
R1202
15K
TP1201
BLACK
R1203
100K
HIGH
ADJ.
LOW
ADJ.
R1207
100K
2W
R1206
150K
2W
R1205
100K
9W
5%
R1204
50K
2W

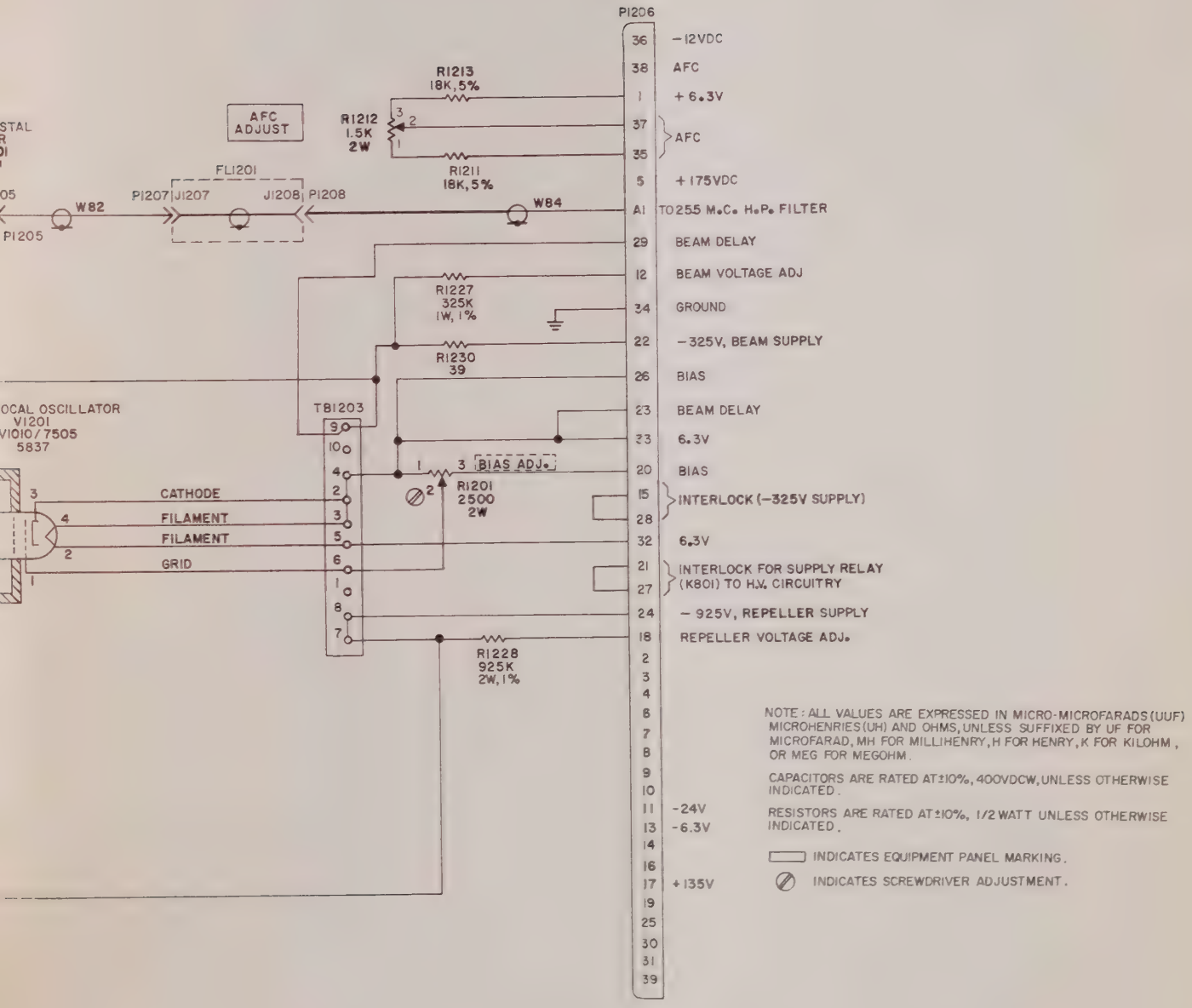
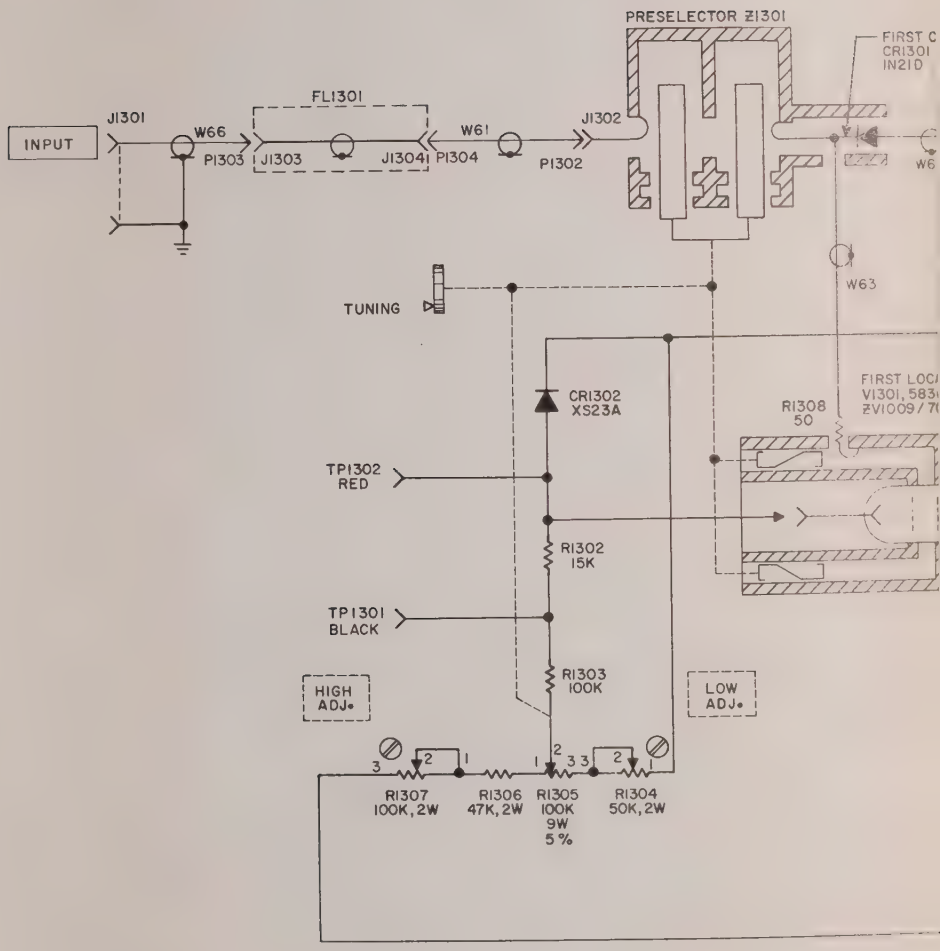
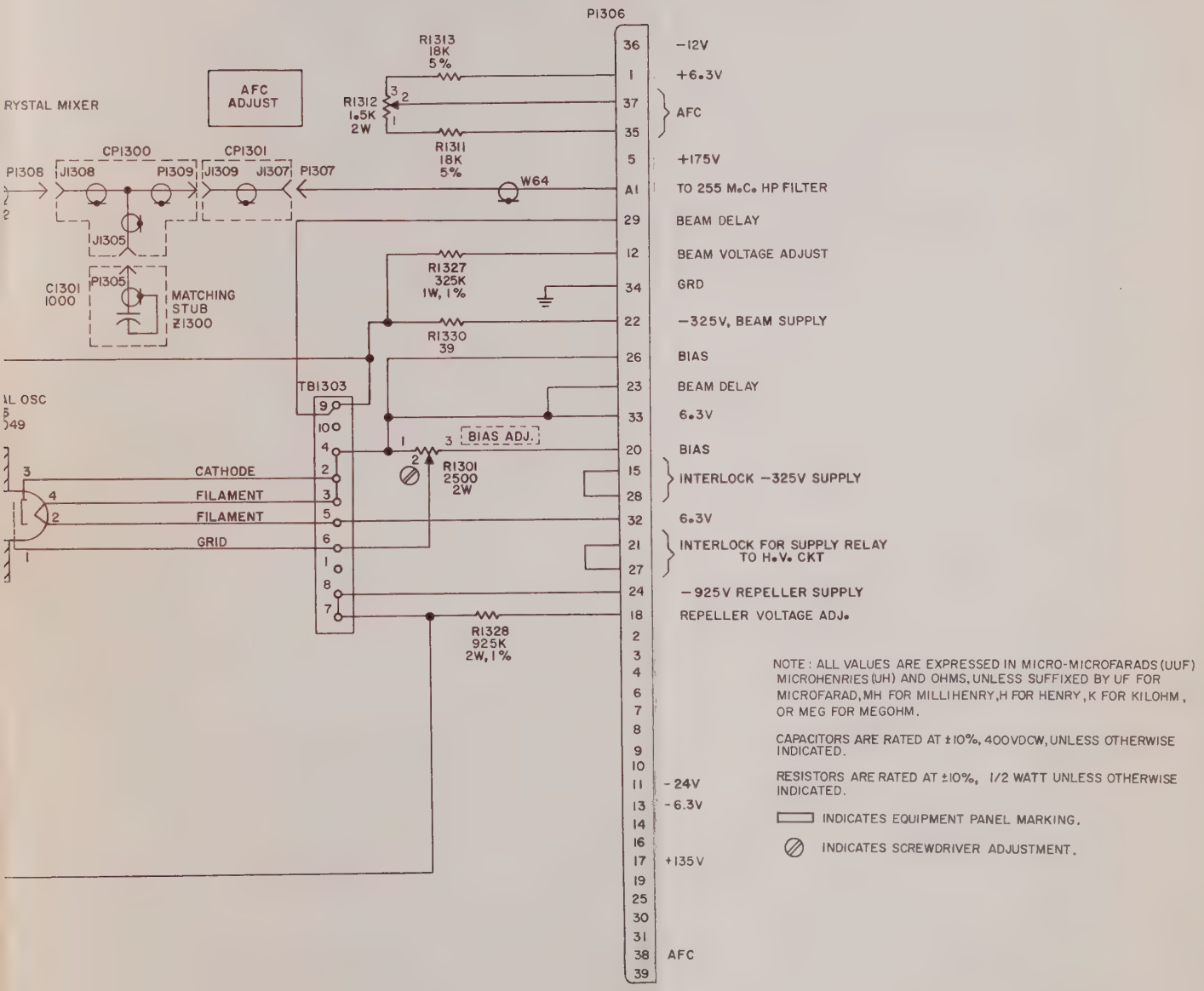


Figure 5-1. Model T-RL Tuning Unit, Schematic Diagram


PRESELECTOR Z1301
FIRST C
CR1301
IN21D
FL1301
INPUT
J1301
W66
P1303
J1303
J1304
P1304
W61
J1302
P1302
W6
W63
TUNING
FIRST LOCA
V1301, 583
ZV1009/7
R1308
50
CR1302
XS23A
TP1302
RED
R1302
15K
TP1301
BLACK
R1303
100K
HIGH
ADJ.
LOW
ADJ.
R1307
100K, 2W
R1306
47K, 2W
R1305
100K
9W
5%
R1304
50K, 2W



NOTE: ALL VALUES ARE EXPRESSED IN MICRO-MICROFARADS (UUF) MICROHENRIES (UH) AND OHMS, UNLESS SUFFIXED BY UF FOR MICROFARAD, MH FOR MILLIHENRY, H FOR HENRY, K FOR KILOHM, OR MEG FOR MEGOHM.

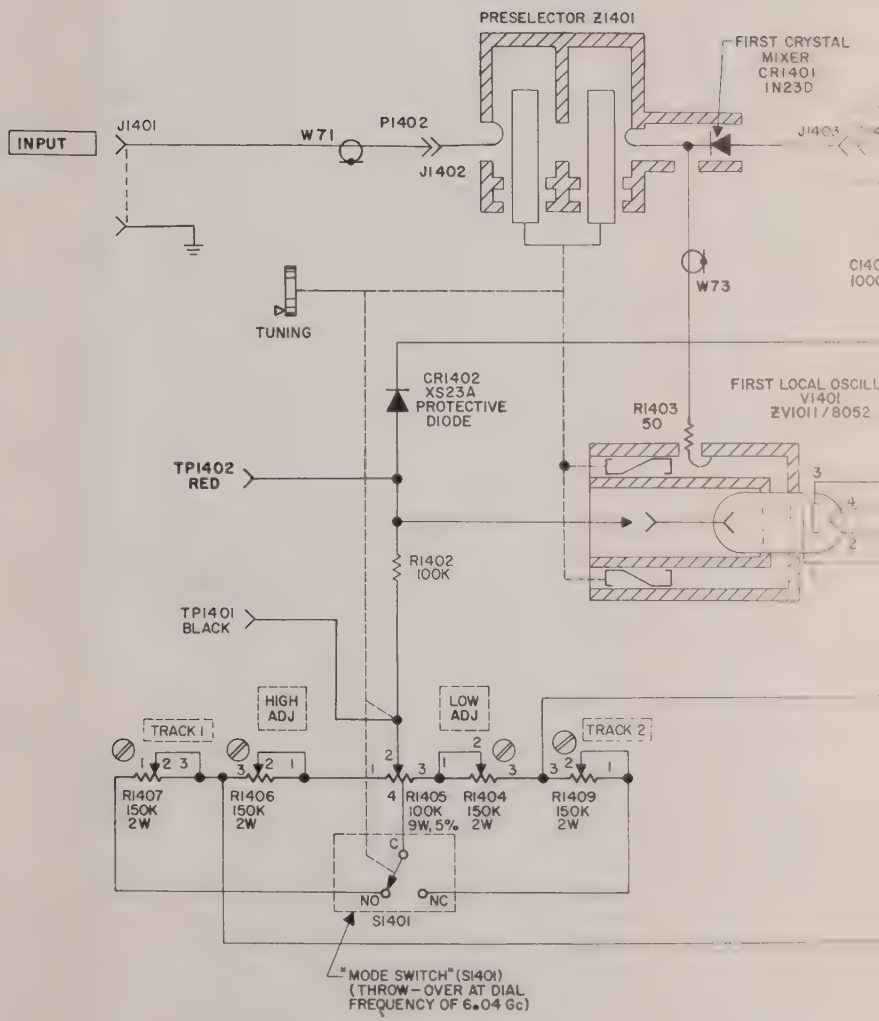
CAPACITORS ARE RATED AT ±10%, 400VDCW, UNLESS OTHERWISE INDICATED.

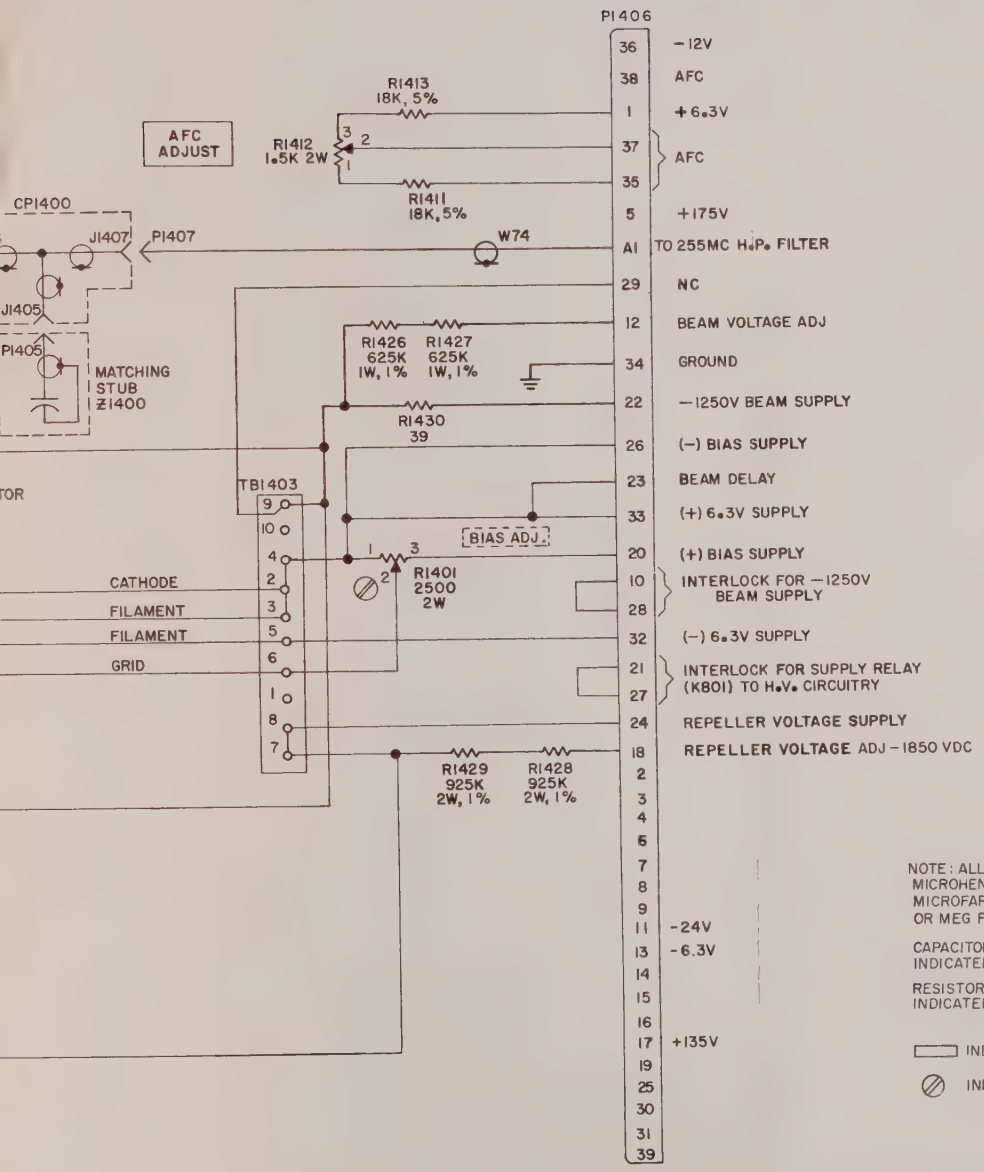
RESISTORS ARE RATED AT ±10%, 1/2 WATT UNLESS OTHERWISE INDICATED.

▭ INDICATES EQUIPMENT PANEL MARKING.

⊘ INDICATES SCREWDRIVER ADJUSTMENT.

Figure 5-2. Model T-RS Tuning Unit, Schematic Diagram


PRESELECTOR Z1401
FIRST CRYSTAL MIXER CR1401 1N23D
INPUT
J1401
W71
P1402
J1402
J1403
W73
TUNING
CR1402 XS23A PROTECTIVE DIODE
R1403 50
FIRST LOCAL OSCILL
V1401 ZV1011/8052
TP1402 RED
R1402 100K
TP1401 BLACK
HIGH ADJ
LOW ADJ
TRACK 1
TRACK 2
R1407 150K 2W
R1406 150K 2W
R1405 100K 9W, 5%
R1404 150K 2W
R1409 150K 2W
C
NO
NC
S1401
"MODE SWITCH" (S1401) (THROW-OVER AT DIAL FREQUENCY OF 6.04 Gc)



NOTE: ALL VALUES ARE EXPRESSED IN MICRO-MICROFARADS (UUF) MICROHENRIES (UH) AND OHMS, UNLESS SUFFIXED BY UF FOR MICROFARAD, MH FOR MILLIHENRY, H FOR HENRY, K FOR KILOHM, OR MEG FOR MEGOHM.

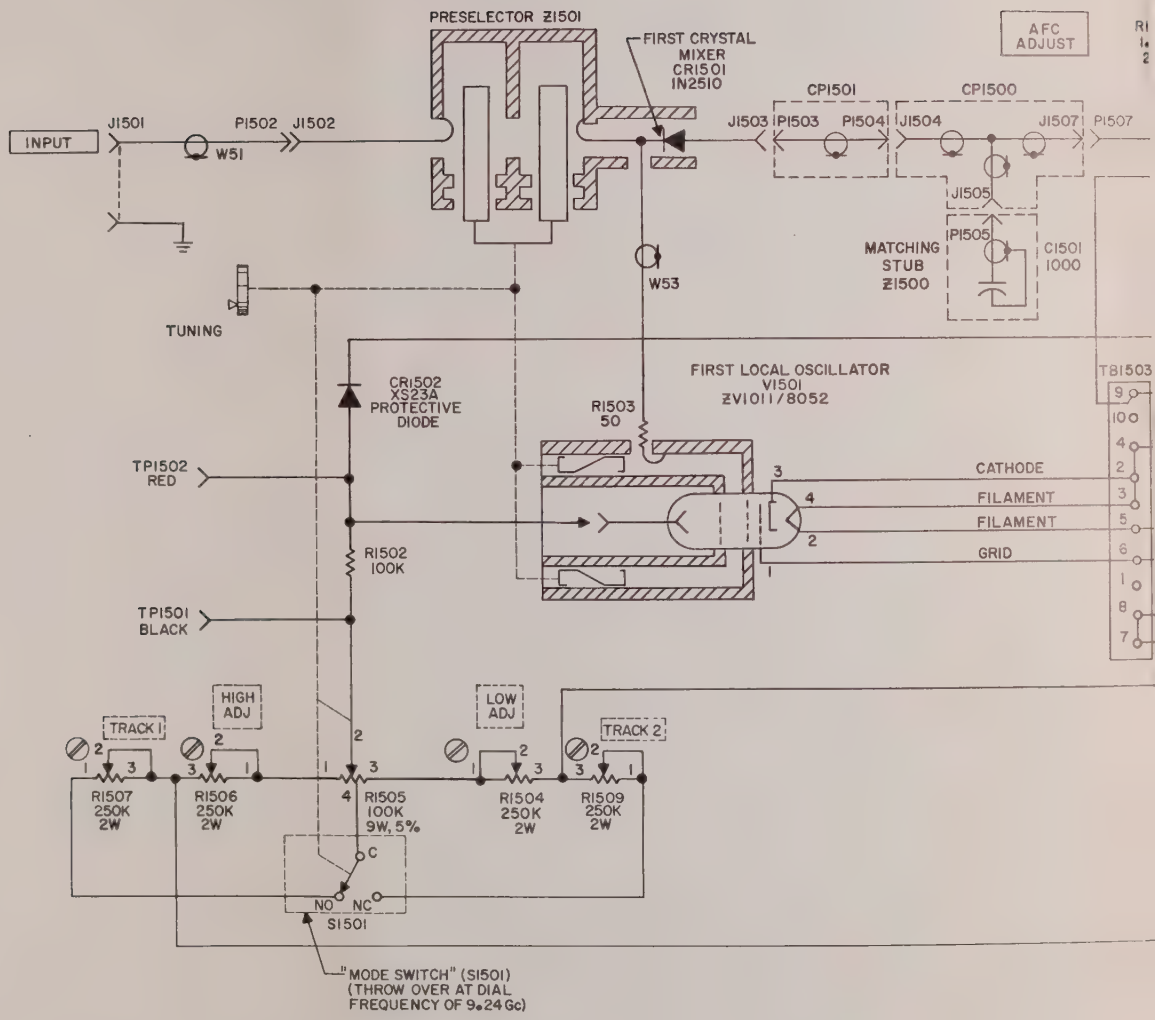
CAPACITORS ARE RATED AT ±10%, 400VDCW, UNLESS OTHERWISE INDICATED.

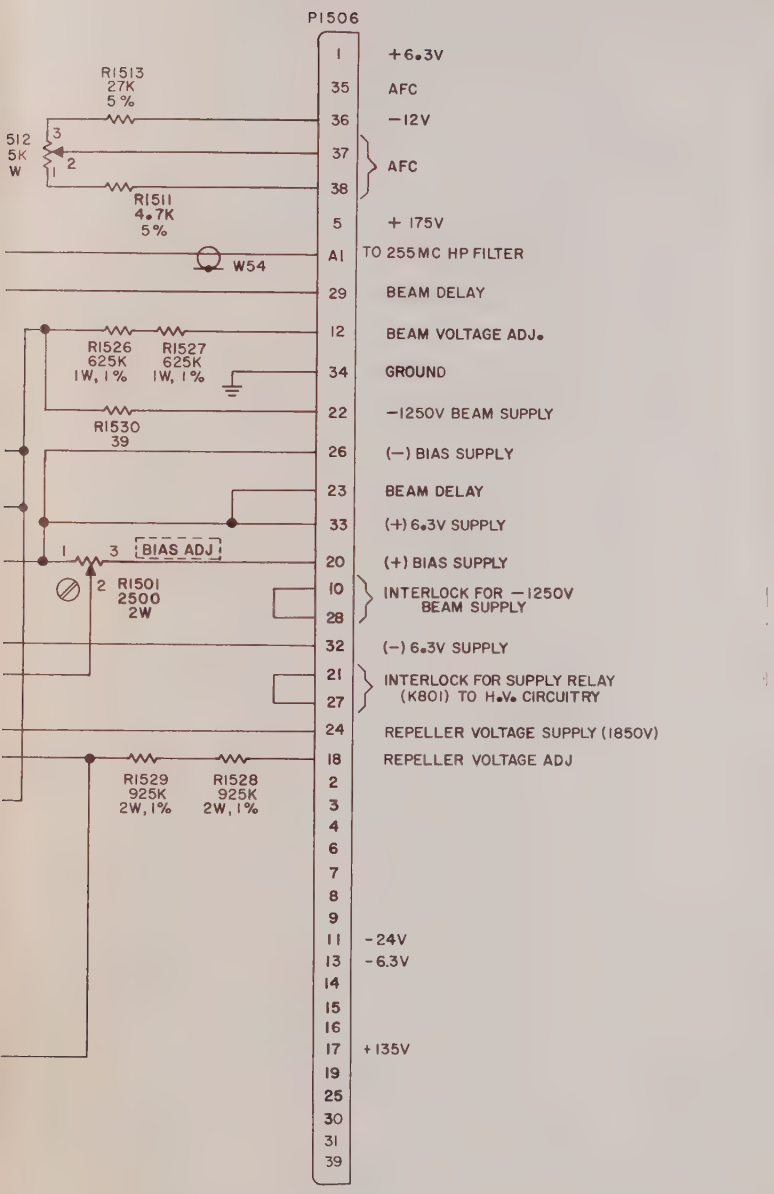
RESISTORS ARE RATED AT ±10%, 1/2 WATT UNLESS OTHERWISE INDICATED.

▭ INDICATES EQUIPMENT PANEL MARKING.

⊘ INDICATES SCREWDRIVER ADJUSTMENT.

Figure 5-3. Model T-RM Tuning Unit, Schematic Diagram


PRESELECTOR Z1501
FIRST CRYSTAL MIXER CR1501 1N2510
AFC ADJUST
INPUT
J1501
P1502 J1502
W51
J1503
P1503
P1504
J1504
J1507
P1507
CP1501
CP1500
J1505
P1505
MATCHING STUB Z1500
C1501 1000
W53
TUNING
CR1502 XS23A PROTECTIVE DIODE
FIRST LOCAL OSCILLATOR V1501 ZV1011/8052
R1503 50
TB1503
TP1502 RED
R1502 100K
TP1501 BLACK
CATHODE
FILAMENT
FILAMENT
GRID
HIGH ADJ
LOW ADJ
TRACK 1
TRACK 2
R1507 250K 2W
R1506 250K 2W
R1505 100K 9W, 5%
R1504 250K 2W
R1509 250K 2W
C
NO
NC
S1501
"MODE SWITCH" (S1501) (THROW OVER AT DIAL FREQUENCY OF 9.24 Gc)



NOTE : ALL VALUES ARE EXPRESSED IN MICRO-MICROFARADS (UUF) MICROHENRIES (UH) AND OHMS, UNLESS SUFFIXED BY UF FOR MICROFARAD, MH FOR MILLIHENRY, H FOR HENRY, K FOR KILOHM, OR MEG FOR MEGOHM.

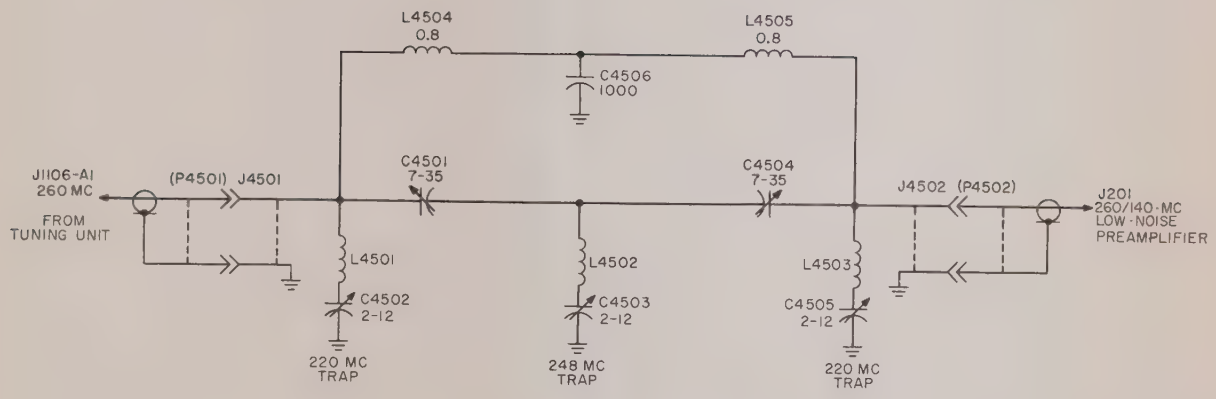
CAPACITORS ARE RATED AT ±10%, 400VDCW, UNLESS OTHERWISE INDICATED.

RESISTORS ARE RATED AT ±10%, 1/2 WATT UNLESS OTHERWISE INDICATED.

▭ INDICATES EQUIPMENT PANEL MARKING.

⊘ INDICATES SCREWDRIVER ADJUSTMENT.

Figure 5-4. Model T-RX Tuning Unit, Schematic Diagram



NOTE:
1. UNLESS OTHERWISE SPECIFIED ALL CAPACITORS ARE IN UUF.
2. ALL INDUCTANCES ARE IN UH.
3. WHERE NOT INDICATED, UNIT OF INDUCTANCE IS LESS THAN 0.1UH.

Figure 5-5. 255-Mc High-Pass Filter, Schematic Diagram

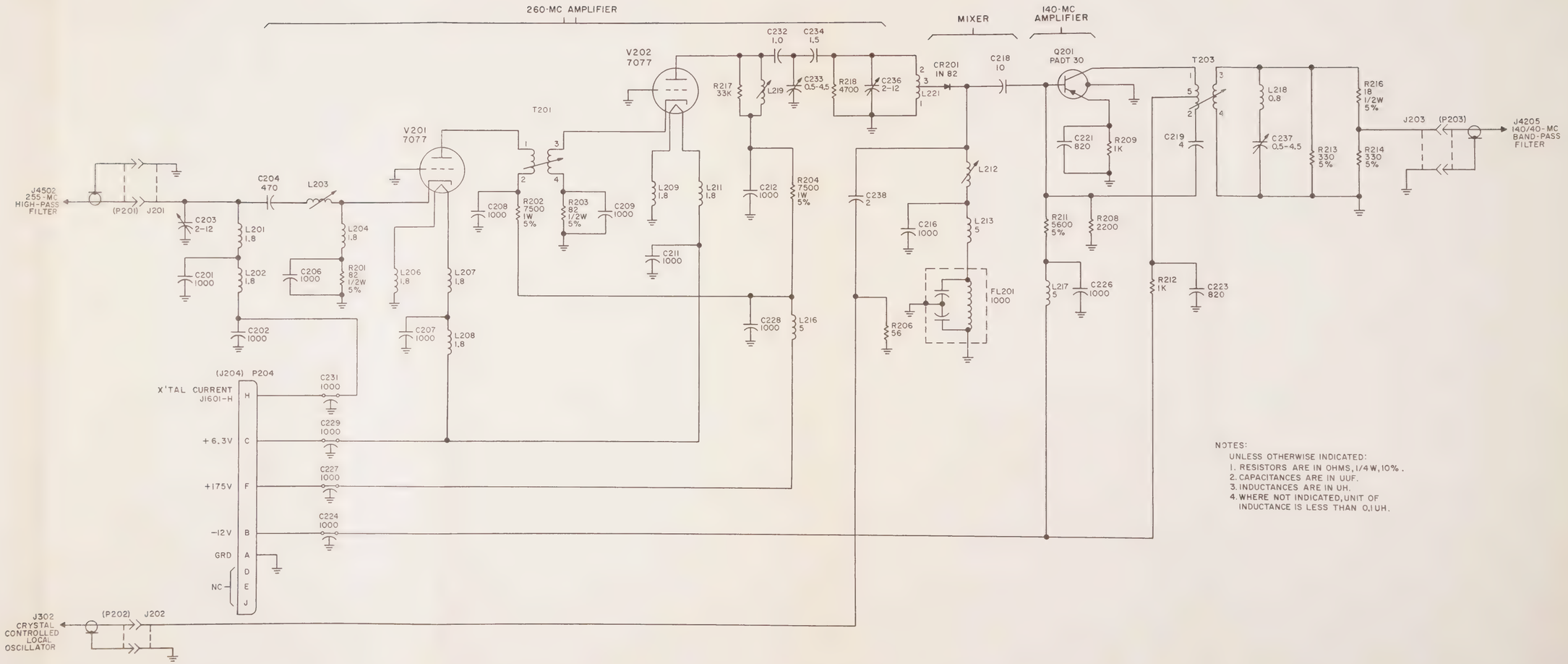
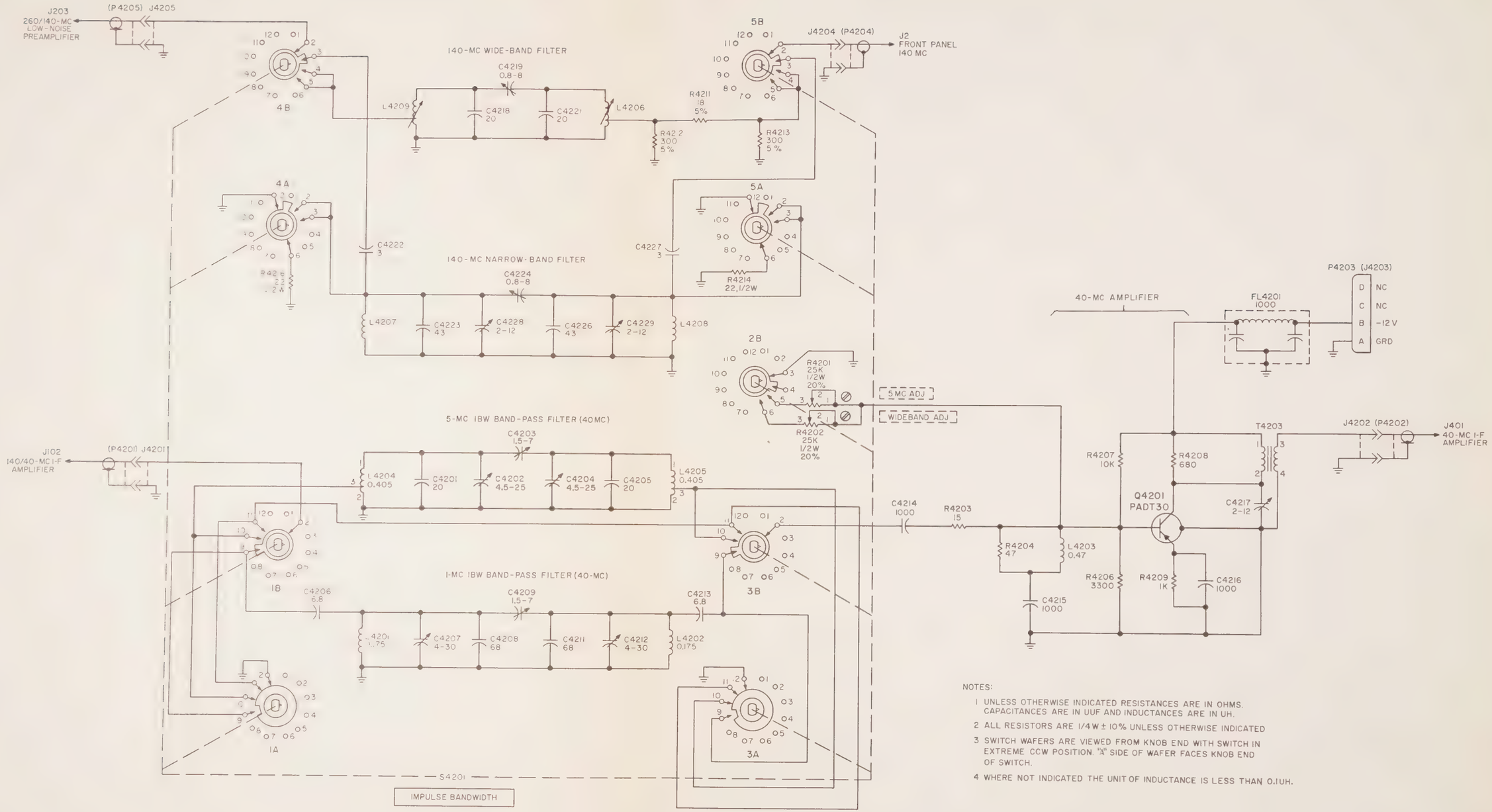


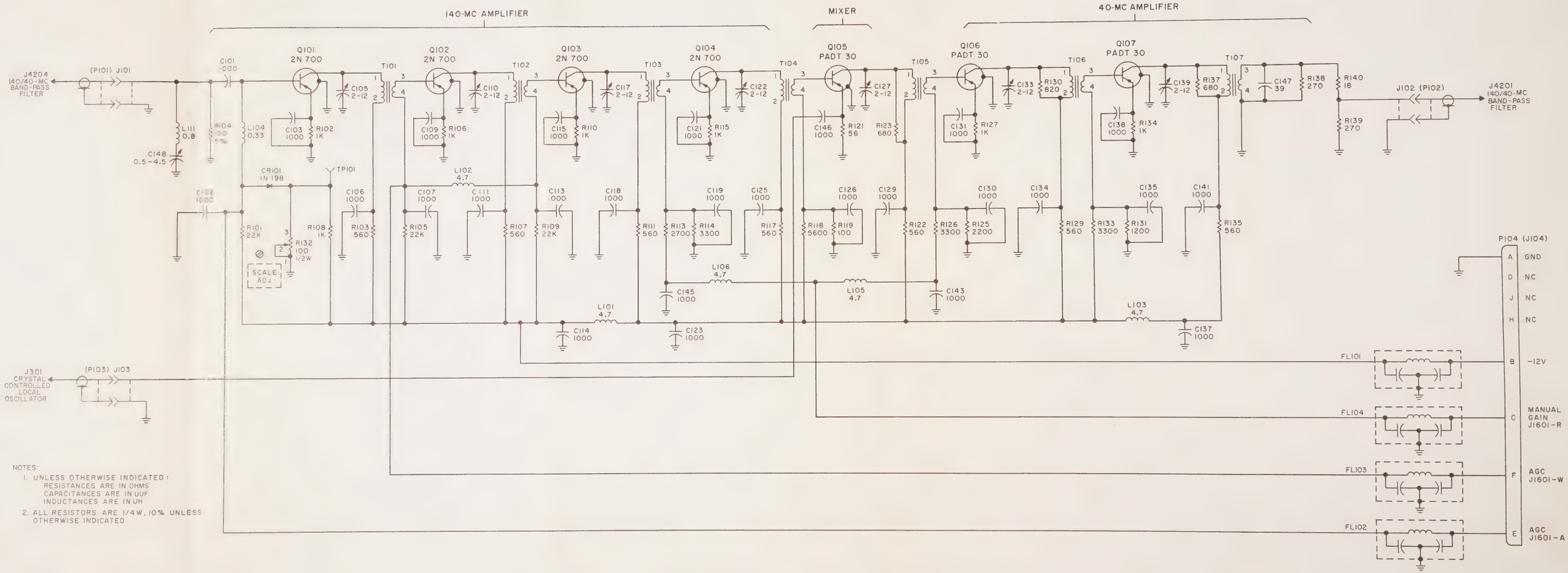
Figure 5-6. 260/140-Mc Low-Noise Preamplifier, Schematic Diagram



NOTES:

1. UNLESS OTHERWISE INDICATED RESISTANCES ARE IN OHMS. CAPACITANCES ARE IN UUF AND INDUCTANCES ARE IN UH.
2. ALL RESISTORS ARE 1/4 W ± 10% UNLESS OTHERWISE INDICATED
3. SWITCH WAFERS ARE VIEWED FROM KNOB END WITH SWITCH IN EXTREME CCW POSITION. "A" SIDE OF WAFER FACES KNOB END OF SWITCH.
4. WHERE NOT INDICATED THE UNIT OF INDUCTANCE IS LESS THAN 0.1UH.

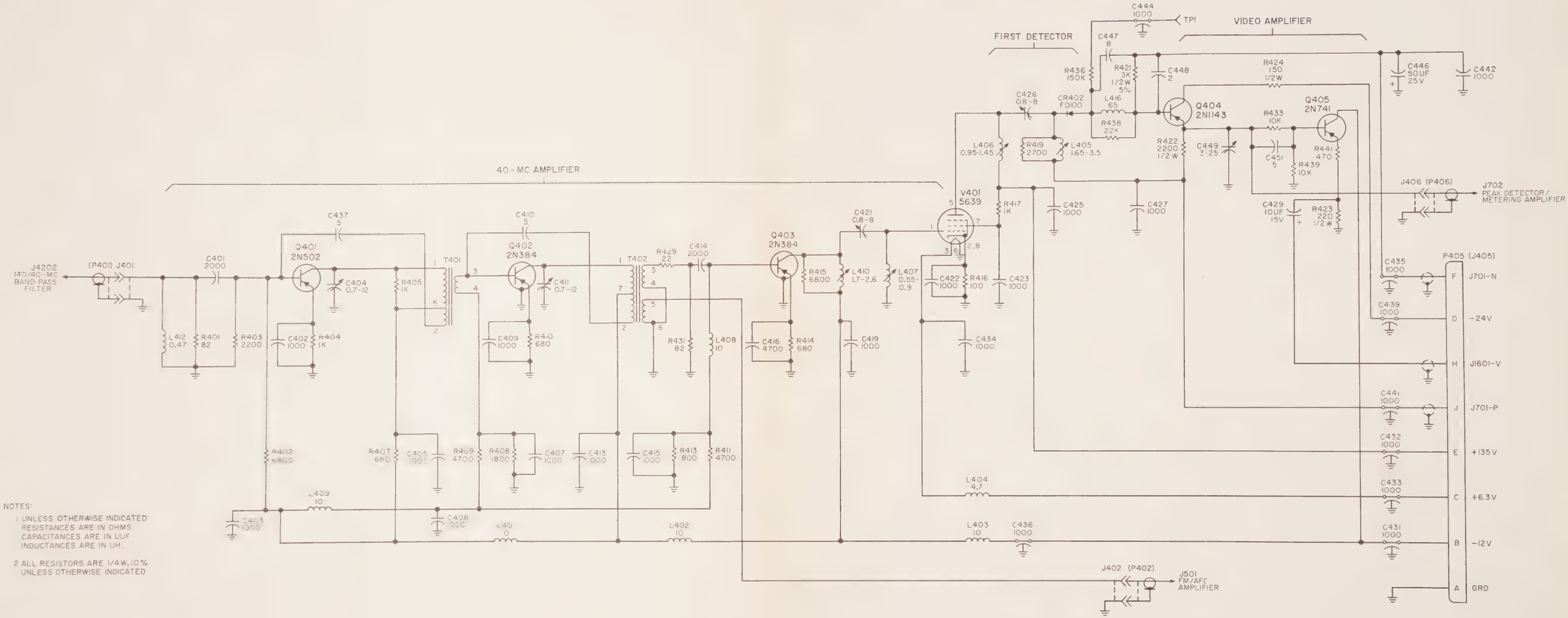
Figure 5-7. 140/40-Mc Band-Pass Filter, Schematic Diagram



NOTES:

1. UNLESS OTHERWISE INDICATED:
   RESISTANCES ARE IN OHMS
   CAPACITANCES ARE IN UUF
   INDUCTANCES ARE IN UH
2. ALL RESISTORS ARE 1/4W, 10% UNLESS OTHERWISE INDICATED

Figure 5-8. 140/40-Mc I-f Amplifier, Schematic Diagram



NOTES:

1 UNLESS OTHERWISE INDICATED: RESISTANCES ARE IN OHMS. CAPACITANCES ARE IN UUF INDUCTANCES ARE IN UH.

2 ALL RESISTORS ARE 1/4W, 10% UNLESS OTHERWISE INDICATED

Figure 5-9. 40-Mc I-f Amplifier, Schematic Diagram

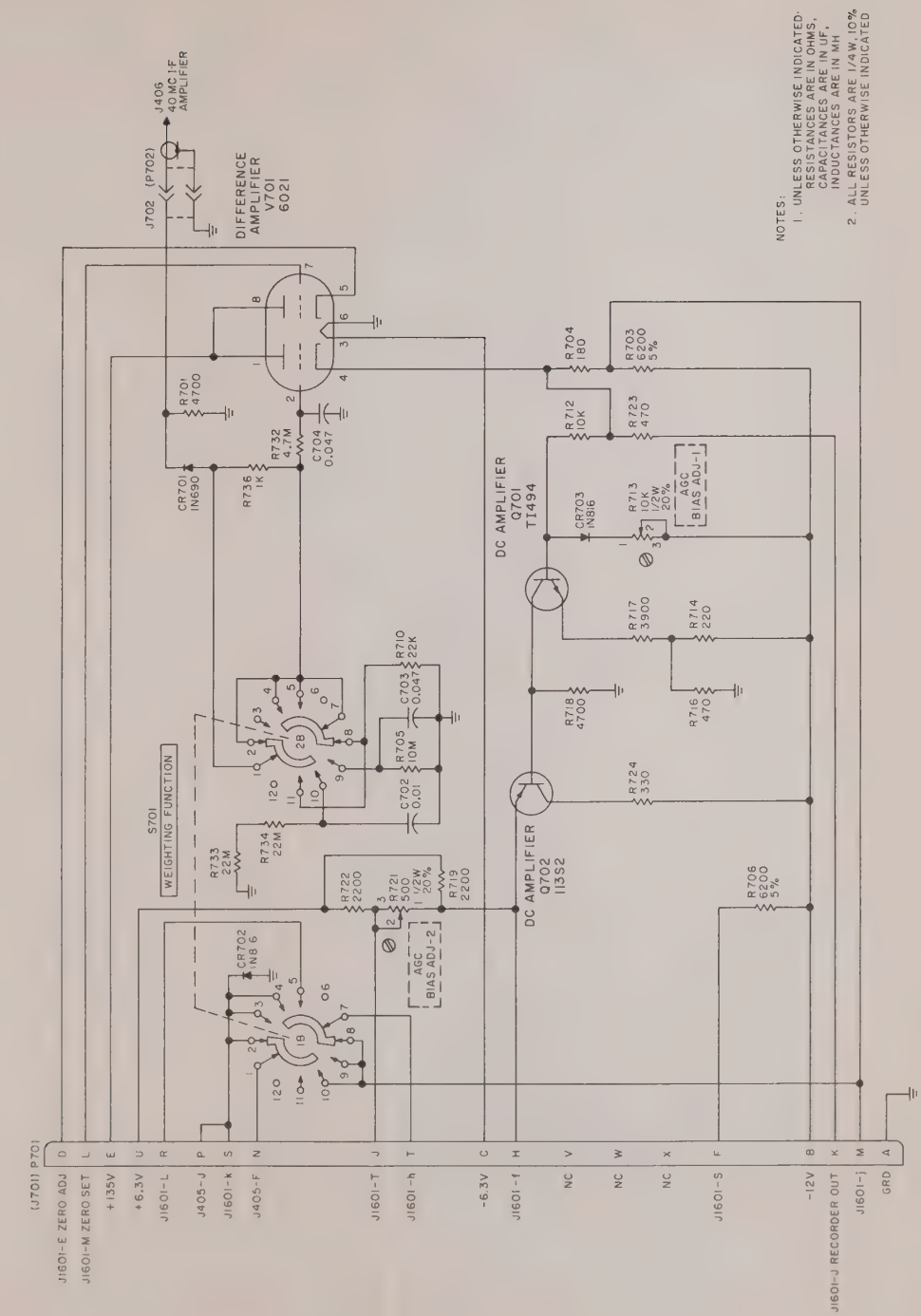
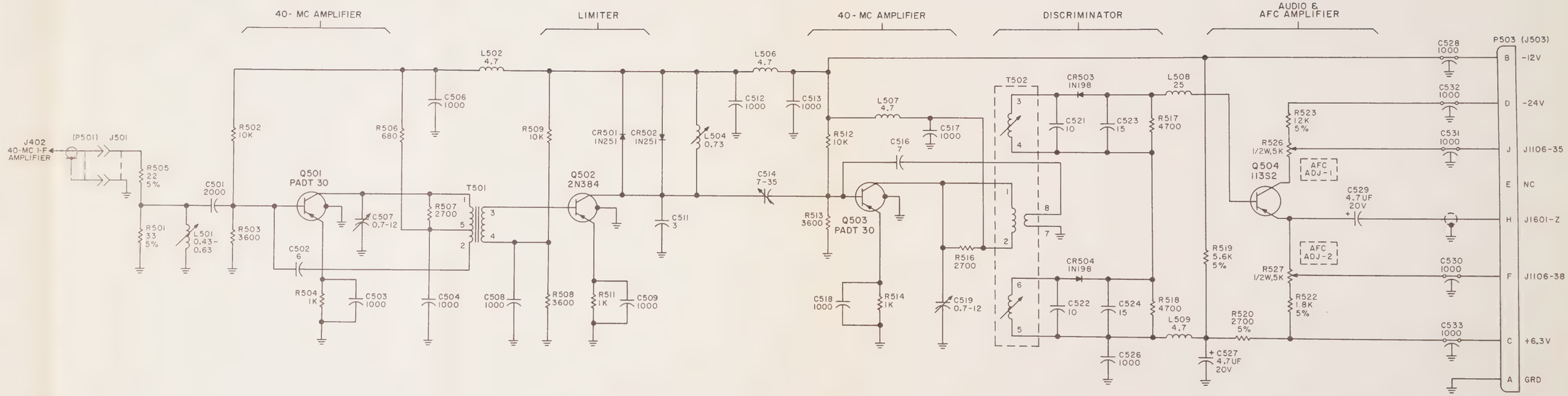
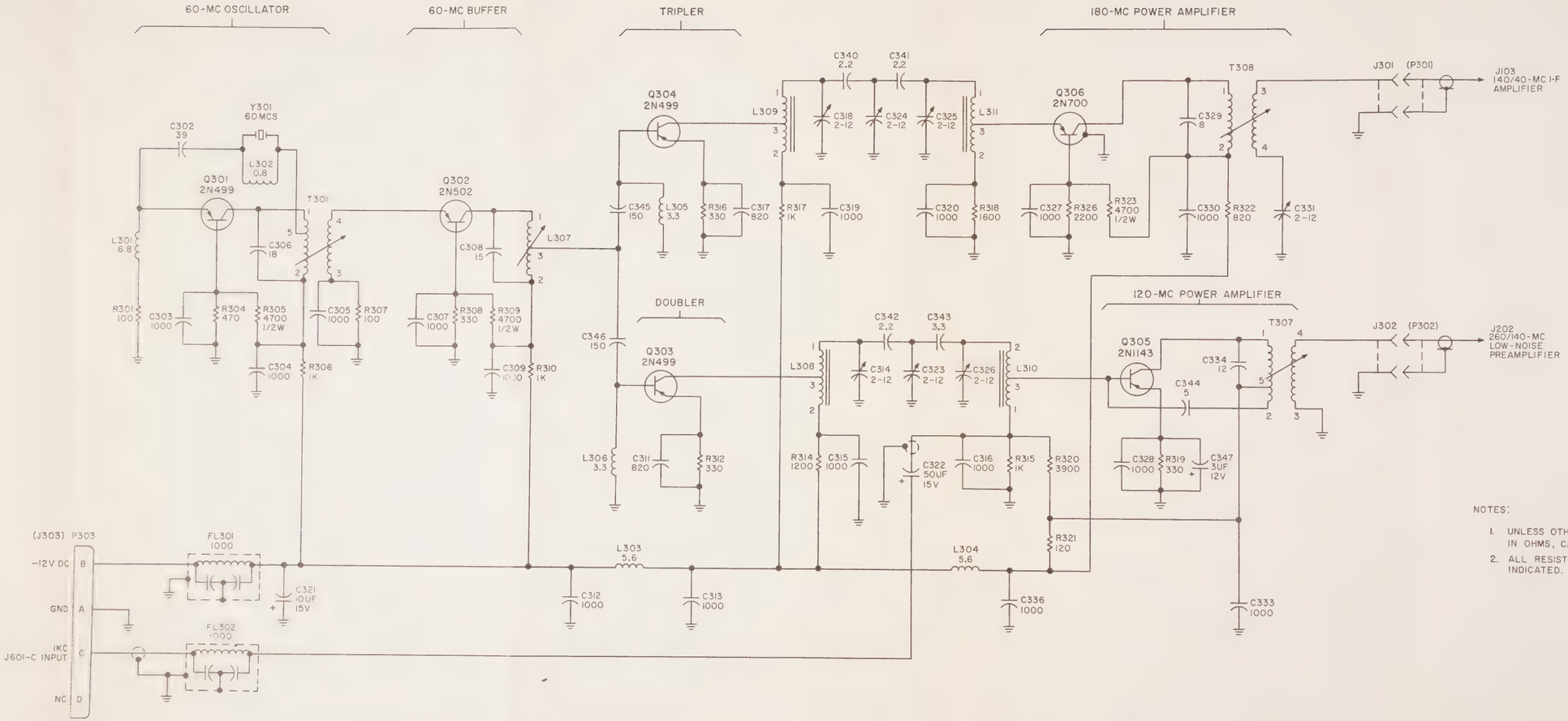


Figure 5-10. Peak Detector/Metering Amplifier, Schematic Diagram



NOTES:
UNLESS OTHERWISE SPECIFIED:
1. ALL RESISTORS ARE IN OHMS 1/4W,10%.
2. ALL CAPACITORS ARE IN MICROMICROFARADS.
3. ALL INDUCTORS ARE IN MICROHENRIES.

Figure 5-11. Fm/Afc Amplifier, Schematic Diagram



NOTES:

1. UNLESS OTHERWISE INDICATED RESISTANCES ARE IN OHMS, CAPACITANCES IN UUF AND INDUCTANCES IN UH.
2. ALL RESISTORS ARE 1/4W ±10% UNLESS OTHERWISE INDICATED.

Figure 5-12. Crystal-Controlled Local Oscillator, Schematic Diagram

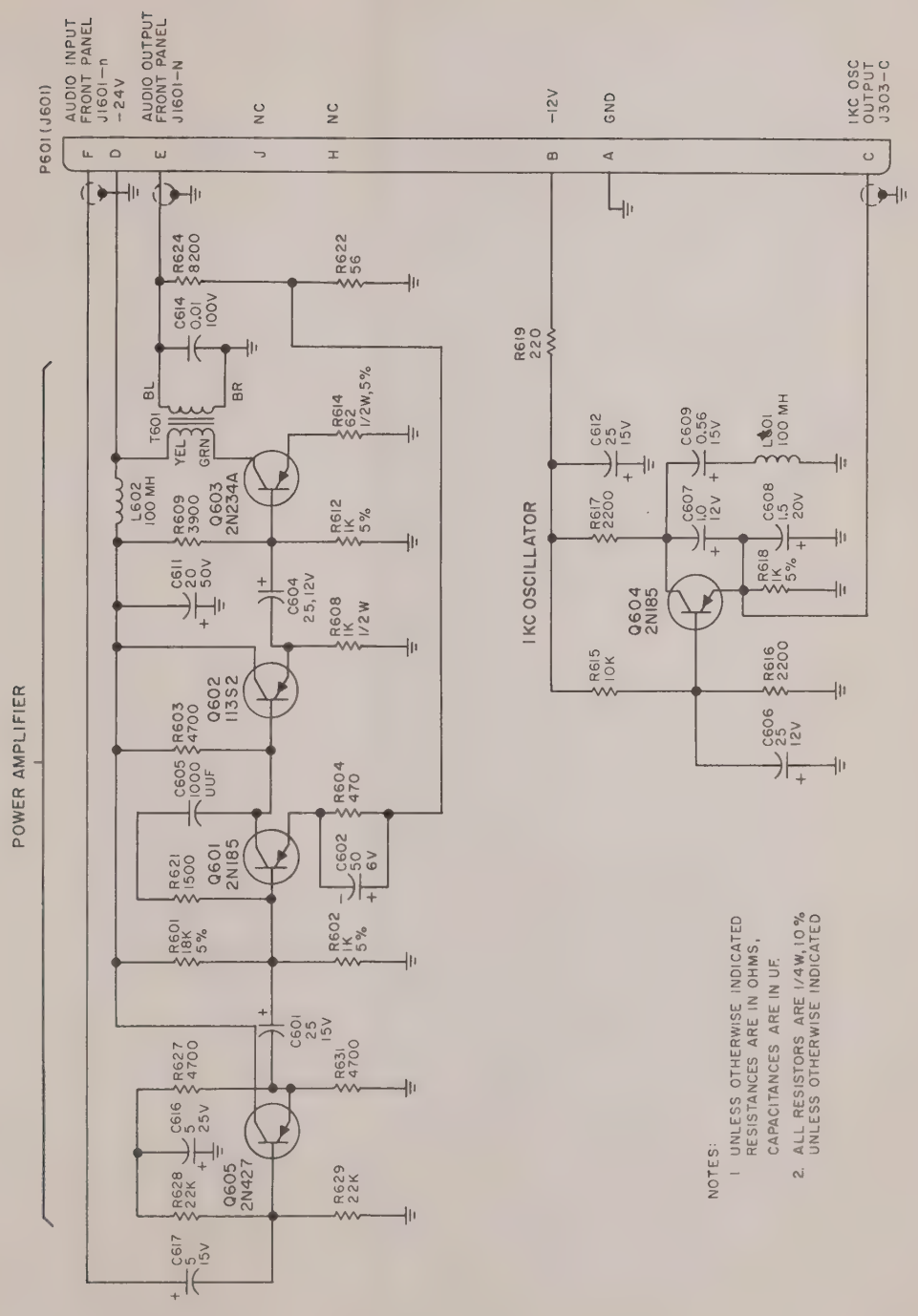
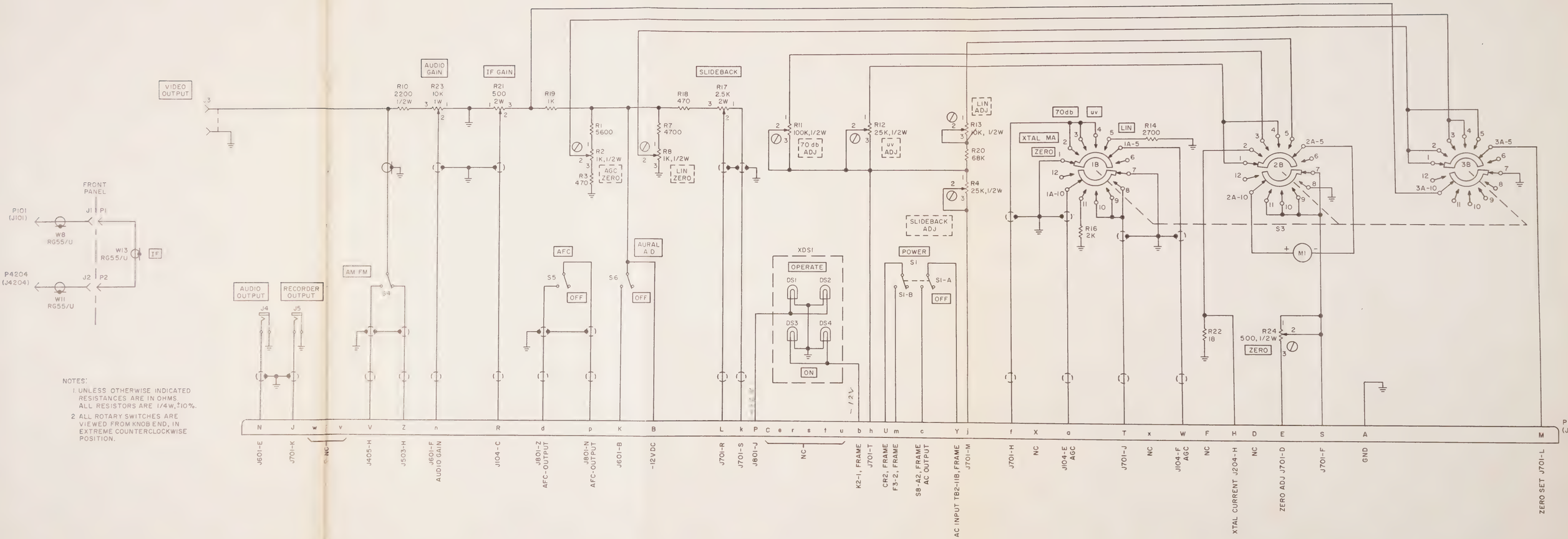


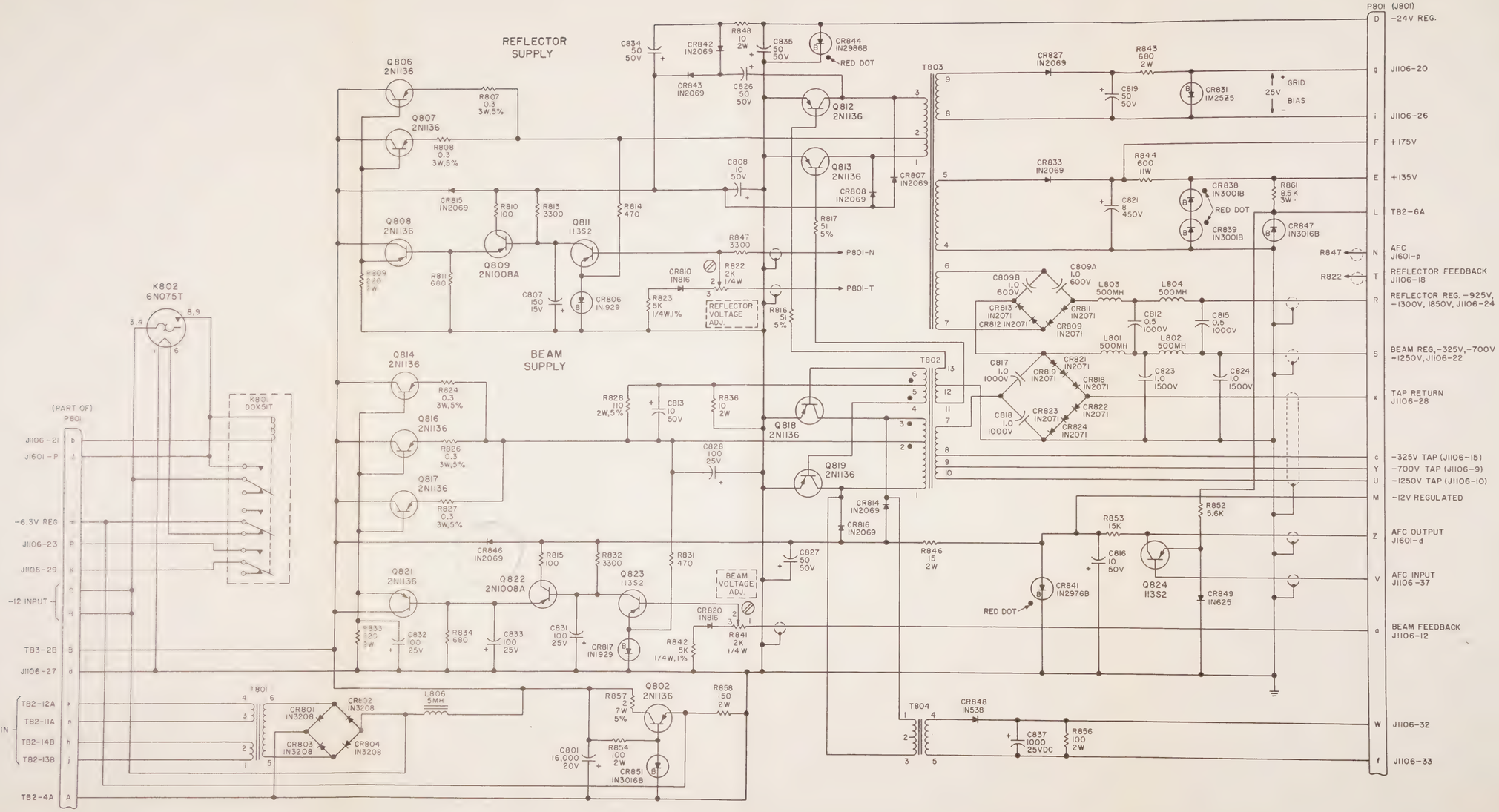
Figure 5-13. 1-Kc Oscillator/Audio Amplifier, Schematic Diagram



NOTES:

1. UNLESS OTHERWISE INDICATED RESISTANCES ARE IN OHMS. ALL RESISTORS ARE 1/4W, ±10%.
2. ALL ROTARY SWITCHES ARE VIEWED FROM KNOB END, IN EXTREME COUNTERCLOCKWISE POSITION.

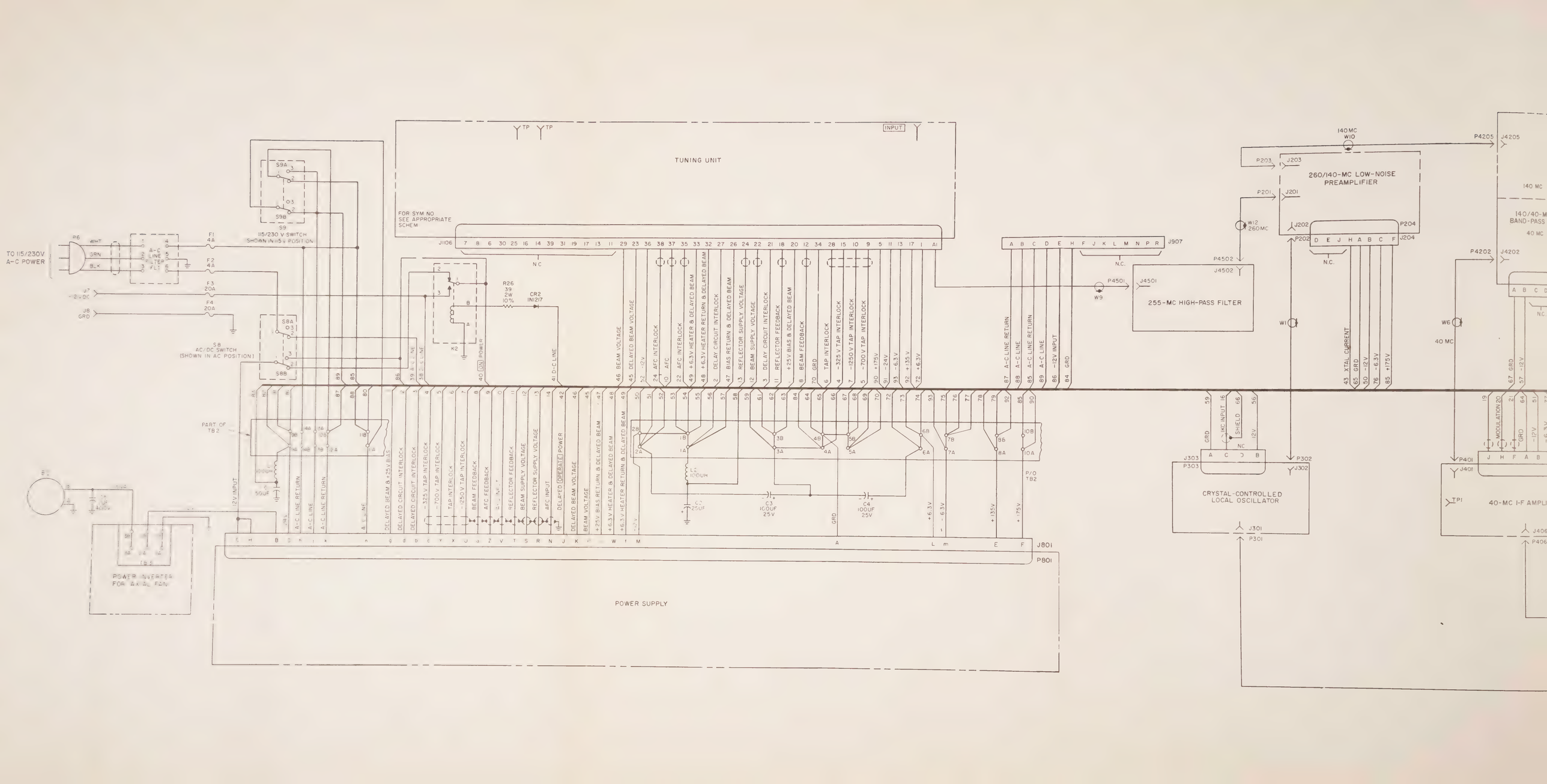
Figure 5-14. Model T-B Basic Unit Front Panel Circuitry, Schematic Diagram



NOTES:

1. ALL VALUES ARE EXPRESSED IN MICROFARADS (UF), MICROHENRIES (UH) AND OHMS, UNLESS SUFFIXED BY UUF FOR MICROMICROFARAD, MH FOR MILLIHENRY, H FOR HENRY, K FOR KILOHM, OR MEG FOR MEGOHM.
2. INDUCTORS ARE RATED AT ±20%, 1000V DC TEST, UNLESS OTHERWISE INDICATED.
3. RESISTORS ARE RATED AT ±10%, 1/2 WATT, UNLESS OTHERWISE INDICATED.
4. ▭ INDICATES EQUIPMENT PANEL MARKING.
5. ⊘ INDICATES SCREWDRIVER ADJUSTMENT.

Figure 5-15. Power Supplies, Schematic Diagram


TUNING UNIT
INPUT
TP
TP
FOR SYM NO SEE APPROPRIATE SCHEM
J1106
N.C.
TO 115/230V A-C POWER
P6
WHT
GRN
BLK
A-C LINE FILTER FL1
F1 4A
F2 4A
F3 20A
F4 20A
J7 -24 DC
J8 GRD
S9A
S9B
S9 115/230 V SWITCH SHOWN IN 115 V POSITION
S8A
S8B
S8 AC/DC SWITCH (SHOWN IN AC POSITION)
R26 39 2W 10%
CR2 IN1217
K2
40 GN POWER
41 D-C LINE
39 A-C LINE
38 A-C LINE
PART OF TB2
12V INPUT
C1 .01UF
C2 50UF
L1 100UH
C3 100UF 25V
C4 100UF 25V
C5 25UF
46 BEAM VOLTAGE
45 DELAYED BEAM VOLTAGE
52 -12V
24 AFC INTERLOCK
10 AFC
22 AFC INTERLOCK
49 +6.3V HEATER & DELAYED BEAM
48 +6.3V HEATER RETURN & DELAYED BEAM
2 DELAY CIRCUIT INTERLOCK
47 BIAS RETURN & DELAYED BEAM
13 REFLECTOR SUPPLY VOLTAGE
12 BEAM SUPPLY VOLTAGE
3 DELAY CIRCUIT INTERLOCK
11 REFLECTOR FEEDBACK
1 +25V BIAS & DELAYED BEAM
8 BEAM FEEDBACK
70 GRD
6 TAP INTERLOCK
4 -325 V TAP INTERLOCK
7 -1250 V TAP INTERLOCK
5 -700 V TAP INTERLOCK
90 +175V
91 -24V
93 -6.3V
92 +135V
72 +6.3V
42 AFC INPUT
11 DELAYED OPERATE POWER
46 DELAYED BEAM VOLTAGE
45 BEAM VOLTAGE
47 +25V BIAS RETURN & DELAYED BEAM
48 +6.3V HEATER & DELAYED BEAM
50 -12V
J801
P801
POWER SUPPLY
POWER INVERTER FOR AXIAL FAN
TB1
TB2
P/O TB2
J907
P4501
W9
J4501
255-MC HIGH-PASS FILTER
87 A-C LINE RETURN
88 A-C LINE
85 A-C LINE RETURN
89 A-C LINE
86 -12V INPUT
84 GRD
140 MC W10
P4205
J4205
P203
J203
260/140-MC LOW-NOISE PREAMPLIFIER
P201
J201
W12 260 MC
P202
J202
P204
J204
P4502
J4502
W1
W6
40 MC
P4202
J4202
140/40-MC BAND-PASS
43 XTAL CURRENT
65 GRD
50 -12V
76 -6.3V
85 +175V
67 GRD
57 -12V
64 -12V
51 -6.3V
59 GRD
16 MC INPUT
66 SHIELD
56 -12V
NC
J303
P303
J302
P302
CRYSTAL-CONTROLLED LOCAL OSCILLATOR
J301
P301
19 MODULATION
20
21
64 GRD
51 -12V
J401
P401
TP1
40-MC I-F AMPLI
J406
P406

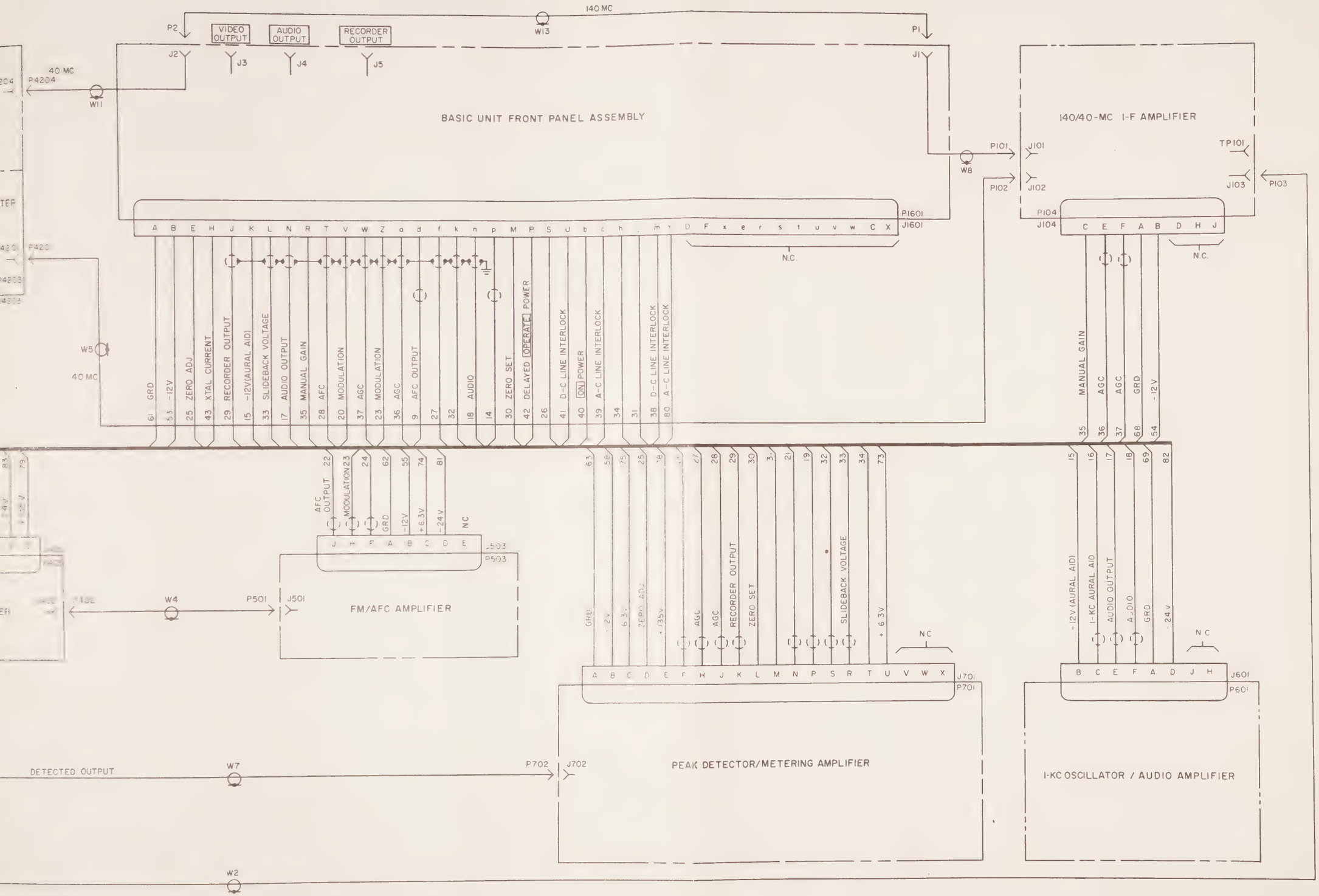


Figure 5-17. Model TR Microwave Receiver, Inter-Chassis Cabling Diagram

TABLE 5-1. 260/140-MC LOW-NOISE PREAMPLIFIER, VOLTAGE MEASUREMENTS

Tube	Tube Type	Filament Voltage	Cathode Voltage	Grid Voltage	Plate Voltage
V201	7077	6.3*	+0.86	0	+110
V202	7077	6.3*	+0.7	0	+110
Transistor	Transistor Type	Emitter Voltage	Base Voltage	Collector Voltage	D-c Beta (nominal)
Q201	PADT 30	-2.8	-3.1	-8.6	100

Notes: All voltages are d-c (with respect to chassis ground) as measured with a vtvm.

Voltages measured with P201, P202, and P203 disconnected from their mating receptacles.

* Voltage measured between filament contacts.

TABLE 5-2. 140/40-MC BAND-PASS FILTER, VOLTAGE MEASUREMENTS

Transistor	Transistor Type	Emitter Voltage	Base Voltage	Collector Voltage	D-c Beta (nominal)
Q4201	PADT 30	-1.1	-1.4	-11.5	100

Notes: All voltages are d-c (with respect to chassis ground) as measured with a vtvm.

Voltages measured with P4201 and P4202 disconnected from their mating receptacles.

TABLE 5-3. 140/40-MC I-F AMPLIFIER, VOLTAGE MEASUREMENTS

Transistor	Transistor Type	Emitter Voltage	Base Voltage	Collector Voltage	D-c Beta (nominal)
Q101	2N700	-0.5	-0.95	-10.5	10
Q102	2N700	-1.1	-1.4	-10.5	10
Q103	2N700	-1.1	-1.4	-10.5	10
Q104	2N700	-1.1	-1.4	-10.5	10
Q105	PADT 30	0	-0.2	-10.5	100
Q106	PADT 30	-0.9	-1.2	-10.5	100
Q107	PADT 30	-2.7	-3.0	-9.2	100

Notes: All voltages are d-c (with respect to chassis ground) as measured with a vtvm.

Voltages measured with P101, P102, and P103 disconnected from their mating receptacles, Scale Selector switch set to LIN, and IF GAIN control rotated fully clockwise.

TABLE 5-4. 40-MC I-F AMPLIFIER, VOLTAGE MEASUREMENTS

Transistor	Transistor Type	Emitter Voltage	Base Voltage	Collector Voltage	D-c Beta (nominal)
Q401	2N502	-2.5	-2.7	-11.5	50
Q402	2N384	-2.8	-3.1	-11.5	50
Q403	2N384	-2.9	-3.2	-11.5	50
Q404	2N1143	-0.6	-0.7	-23.0	25
Q405	2N741	-0.1	-0.3	-11.5	25

Tube	Tube Type	Pin Number								
		1	2	3	4	5	6	7	8	
V401	5639	0	+2.8	-5.5	-	+125	0	+120	+2.8	

Notes: All voltages are d-c (with respect to chassis ground) as measured with a vtvm.

Voltages measured with P401, P402, and P406 disconnected from their mating receptacles.

TABLE 5-5. PEAK DETECTOR/METERING AMPLIFIER, VOLTAGE MEASUREMENTS

Transistor	Transistor Type	Emitter Voltage	Base Voltage	Collector Voltage	D-c Beta (nominal)
Q701	TI494	-4.8	-4.2	-1.5	50
Q702	113S2	-0.9	-1.5	-6.3	50

Tube	Tube Type	Pin Number								
		1	2	3	4	5	6	7	8	
V701	6021	+120	0	-6.3	+2.8	+2.9	0	-0.2	+120	

Notes: All voltages are d-c (with respect to chassis ground) as measured with a vtvm.

Voltages measured with WEIGHTING FUNCTION switch set to AVG, Scale Selector switch set to LIN, and P702 disconnected from its mating receptacle.

TABLE 5-6. FM/AFC AMPLIFIER, VOLTAGE MEASUREMENTS

Transistor	Transistor Type	Emitter Voltage	Base Voltage	Collector Voltage	D-c Beta (nominal)
Q501	PADT 30	-2.7	-2.9	-10.0	100
Q502	2N384	-2.7	-2.9	-12.0	50
Q503	PADT 30	-2.9	-3.2	-11.5	100
Q504	113S2	+0.1	+0.5	-5.5	50

Notes: All voltages are d-c (with respect to chassis ground) as measured with a vtvm.

Voltages measured with P501 disconnected from its mating receptacle.

TABLE 5-7. CRYSTAL-CONTROLLED LOCAL OSCILLATOR, VOLTAGE MEASUREMENTS

Transistor	Transistor Type	Emitter Voltage	Base Voltage	Collector Voltage	D-c Beta (nominal)
Q301	2N499	-0.4	-0.5	-7.0	50
Q302	2N502	-0.4	-0.3	-6.0	50
Q303	2N499	-0.7	0	-9.2	50
Q304	2N499	-0.7	0	-9.4	50
Q305	2N1143	-1.8	-2.1	-11.0	25
Q306	2N700	-2.5	-2.7	-9.4	10

Notes: All voltages are d-c (with respect to chassis ground) as measured with a vtvm.

Voltages measured with P301 and P302 disconnected from their mating receptacles.

TABLE 5-8. 1-KC OSCILLATOR/AUDIO AMPLIFIER, VOLTAGE MEASUREMENTS

Transistor	Transistor Type	Emitter Voltage	Base Voltage	Collector Voltage	D-c Beta (nominal)
Q601	2N185	-1.0	-1.1	-13.0	50
Q602	113S2	-12.5	-13.0	-24.0	50
Q603	2N234A	-3.5	-3.7	-24.0	25
Q604	2N185	-2.1	-2.0	-7.4	50
Q605	2N427	-9.7	-9.9	-24.0	50

Notes: All voltages are d-c (with respect to chassis ground) as measured with a vtvm.

Voltages measured with AURAL AID OFF switch set to AURAL AID.

TABLE 5-9. POWER SUPPLIES, VOLTAGE MEASUREMENTS

Transistor	Transistor Type	Emitter Voltage	Base Voltage	Collector Voltage	D-c Beta (nominal)
Q802	2N1136	-6.4	-6.8	-9.7	50
Q806	2N1136	-8.5	-9.7	-12.8	50
Q807	2N1136	-8.5	-9.7	-12.8	50
Q808	2N1136	-9.7	-9.8	-12.8	50
Q809	2N1008A	-9.8	-10.0	-15.5	50
Q811	113S2	-6.0	-6.5	-10.0	50
Q812	2N1136	0	+2.3	-8.5	50
Q813	2N1136	0	+2.3	-8.5	50
Q814	2N1136	-8.0	-9.0	-12.8	50
Q816	2N1136	-8.0	-9.0	-12.8	50
Q817	2N1136	-8.0	-9.0	-12.8	50
Q818	2N1136	0	+5.0	-8.0	50
Q819	2N1136	0	+5.0	-8.0	50
Q821	2N1136	-9.0	-9.2	-12.8	50
Q822	2N1008A	-9.2	-9.4	-13.5	50
Q823	113S2	-6.0	-6.5	-9.4	50
Q824	113S2	+0.08 (f)	-0.3 (f)	-10.5	50

(Cont'd)

TABLE 5-9. POWER SUPPLIES, VOLTAGE MEASUREMENTS (Cont'd)

Diode	Diode Type	Cathode Voltage	Anode Voltage
CR801	1N3208	0	-7.0
CR802	1N3208	-7.0	-14.0
CR803	1N3208	0	-7.0
CR804	1N3208	-7.0	-14.0
CR806	1N1927	0	-6.0
CR807	1N2069	-8.5	-17.2
CR808	1N2069	-8.5	-17.2
CR809	1N2071	-300 (a)	-500 (a)
CR810	1N816	-5.4	-4.5
CR811	1N2071	-500 (a)	-600 (a)
CR812	1N2071	0 (a)	-300 (a)
CR813	1N2071	0 (a)	0 (a)
CR814	1N2069	-8.0	-15.3
CR815	1N2069	-12.8	-17.2
CR816	1N2069	-8.0	-15.0
CR817	1N1929	0	-6.0
CR818	1N2071	-160 (b) -600 (c)	-170 (b) -750 (c)
CR819	1N2071	-170 (b) -750 (c)	-327 (b) -1150 (c)
CR820	1N816	-5.6	-5.0
CR821	1N2071	-327 (b) -1150 (c)	-330 (b) -1250 (c)
CR822	1N2071	-115 (b) -530 (c)	-160 (b) -600 (c)
CR823	1N2071	0 (b) 0 (c)	-115 (b) -530 (c)
CR824	1N2071	0 (b) 0 (c)	0 (b) 0 (c)
CR827	1N2069	+37 (d)	0 (d)
CR831	1M25Z5	+27 (d)	0 (d)
CR833	1N2069	+173	0
CR838	1N3001B	+123	+54

(Cont'd)

TABLE 5-9. POWER SUPPLIES, VOLTAGE MEASUREMENTS (Cont'd)

Diode	Diode Type	Cathode Voltage	Anode Voltage
CR839	1N3001B	+54	0
CR841	1N2976B	0	-11.7
CR842	1N2069	-22	-26.3
CR843	1N2069	-17.2	-22
CR844	1N2986B	0	-24
CR846	1N2069	-13	-15.3
CR847	1N3016B	+6.9	0
CR848	1N538	+6.5 (e)	0 (e)
CR849	1N625	+0.08 (f)	0 (f)
CR850	1N3016B	0	-6.8

Notes: Unless otherwise noted, all voltages are d-c (as measured by a vtvm) with respect to basic unit ground.

(a) Measured with respect to anode of CR821.
(b) Measured with a differential voltmeter (Model T-RL or T-RS Tuning Unit installed).
(c) Measured with a differential voltmeter (Model T-RM or T-RX Tuning Unit installed).
(d) Measured with respect to pin 8 of T803.
(e) Measured with respect to pin 5 of T804.
(f) AFC OFF switch set to OFF.

(Cont'd)

SECTION VI

PARTS LIST

6-1. INTRODUCTION.

6-2. This parts list provides an alpha-numerical listing, in reference symbol sequence of the replaceable electrical, certain electro-mechanical, and mechanical parts of the equipment.

6-3. ORDERING INFORMATION. Orders for parts should contain the following information:

a. Equipment name and model.
b. Serial number.
c. Reference symbol of part.
d. Manufacturer's part number and code.

6-4. HOW TO USE THE PARTS LIST.

6-5. An explanation of the structure of the parts list, Table 6-2, and the meaning of the entries in the five columns are given in the following paragraphs. (See Figure 6-1.)

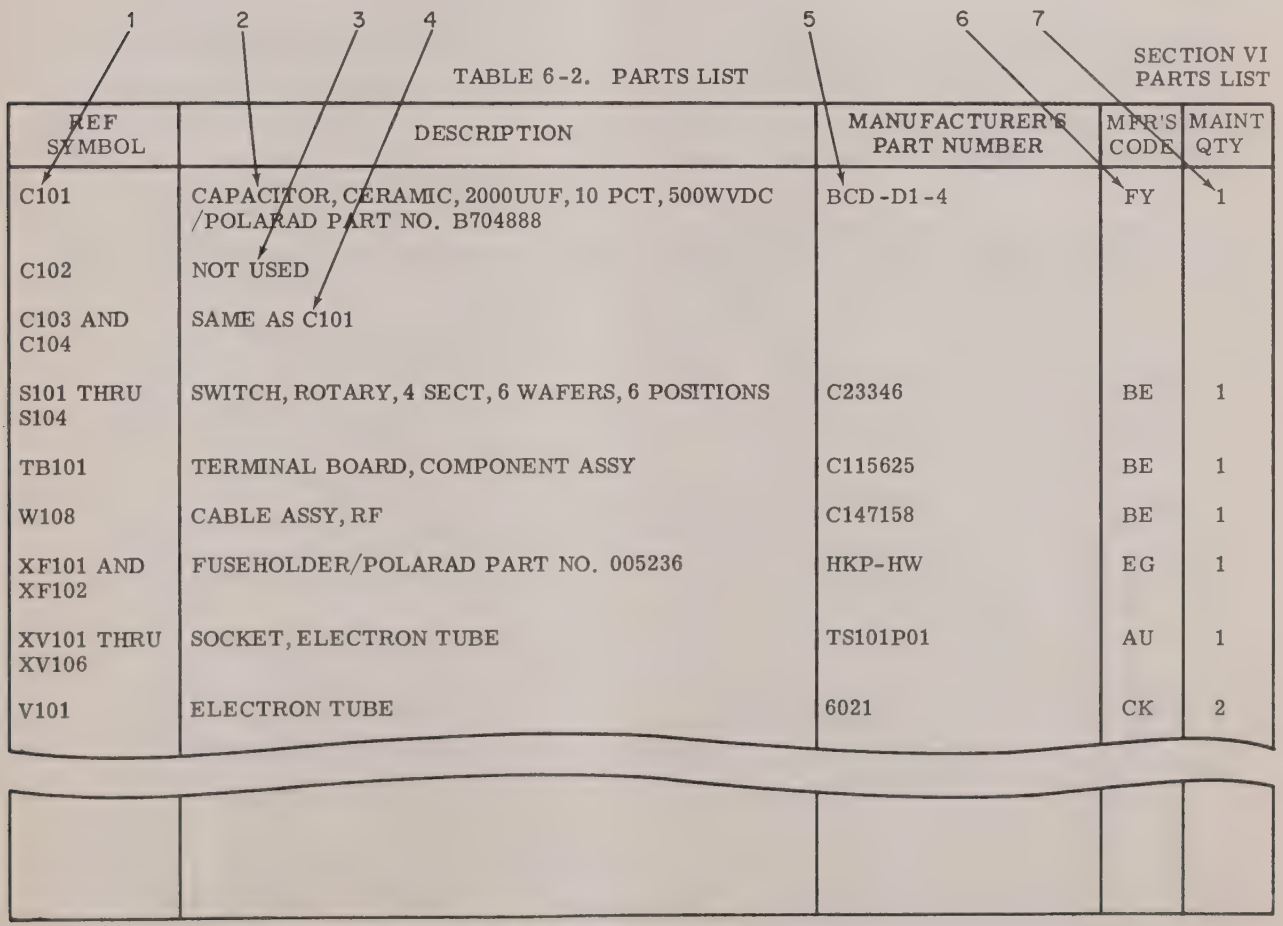


Figure 6-1. Parts List Example

6-6. REFERENCE SYMBOL COLUMN. The reference symbol column (1, Figure 6-1) contains the reference symbol assigned to each part, which also identifies the part on the schematic diagram or in an illustration. The listing is in alpha-numerical order.

6-7. DESCRIPTION COLUMN. The description column (2) contains the description for each part. When the same part is used more than once in the equipment, the second and subsequent listings for that part use the phrase "SAME AS ___" (4) in the description column and the remaining columns (5, 6, and 7) are left blank. When a reference symbol designation has not been used or its assignment has been cancelled, the description column contains the phrase "NOT USED" (3).

6-8. MANUFACTURER'S PART NUMBER COLUMN. The manufacturer's part number column (5) contains the part number assigned by the manufacturer of the part, except for "SAME AS ___" and "NOT USED" listings.

6-9. MANUFACTURER'S CODE COLUMN. The manufacturer's code column (6) contains a letter code identifying the manufacturer of the part. Table 6-1 contains a listing of the letter codes and the manufacturers names and addresses.

6-10. MAINTENANCE QUANTITY COLUMN. The maintenance quantity column (7) contains the recommended maintenance quantity for each part, based on a one year requirement for an equipment in operation or 10 hours a day throughout the year. The recommended maintenance quantities will provide a high degree of equipment reliability in areas where an adequate supply of replacement parts is not available. The recommended maintenance quantity is listed for the initial occurrence of the part in the parts list, but covers all subsequent listings.

6-11. To determine recommended maintenance quantity for periods other than one year, multiply the one-year quantity by the desired period, expressed in years.

6-12. To determine recommended maintenance quantity for operating periods other than 10 hours per day, use the equation given below.

$$MQ' = MQ \times \frac{HR_{op}}{10}$$

where: MQ = Maintenance quantity from Table 6-2

MQ' = Maintenance quantity for desired operating period

HR_{op} = Operating period in hours

Round off the quantity obtained to the nearest whole number.

TABLE 6-1. MANUFACTURER'S CODE

CODE	NAME AND ADDRESS
A	Aeronautical Standards Group, Dept. of Navy & Air Force, Washington, D. C.
B	Aerovox Corp., New Bedford, Mass.
C	Alden Products Co., Brockton, Mass.
D	Allen-Bradley Co., Milwaukee, Wis.
E	Amperite Co., New York, N. Y.
F	Amphenol Connector Division of Amphenol-Borg Electronics Corp., Chicago, Ill.
G	Belden Mfg. Co., Chicago, Ill.
H	Bendix Semiconductor Division of Bendix Corp., Holmdel, N. J.
J	Birnbach Radio Co., New York, N. Y.
K	Birtcher Corp., Los Angeles, Calif.
L	Boston Gear Works Division of Murray Co. of Texas, Boston, Mass.
M	Shallcross Mfg. Co., Selma, N. C.
N	Bourns Laboratories, Inc., Riverside, Calif.
P	Centralab Division of Globe-Union, Inc., Milwaukee, Wis.
Q	Chatam Electronics Division of Tung-Sol Electric, Inc., Livingston, N. J.
R	Cinch Mfg. Co., Division of United-Carr Fastener Corp., Chicago, Ill.
S	Clarostat Mfg. Co., Inc., Dover, N. H.
T	Condenser Products Co., Brooksville, Fla.
U	Cornell-Dubilier Electric Corp., Newark, N. J.
V	Dialight Corp., Brooklyn, N. Y.
W	Eby, S. E., Co., Philadelphia, Pa.
X	Elco Corp., Philadelphia, Pa.
Y	Erie Resistor Corp., Erie, Pa.
Z	General Electric Co., Miniature Lamp Department of Lamp Division of Consumer Products Group, Cleveland, Ohio
AA	General Electric Co., Semi-Conductor Products Department of Electronic Components Division of Electronic, Atomic and Defense Systems Group, Syracuse, N. Y.
AB	General Transistor Western Corp., Los Angeles, Calif.
AC	Good-All Electric Mfg. Co., Ogallala, Nebr.
AD	Hammarlund Co., Inc., New York, N. Y.
AE	Harvey Hubbell, Inc., Bridgeport, Conn.
AF	Helipot Division of Beckman Instruments, Inc., Fullerton, Calif.
AG	Hopkins Engineering Co., San Fernando, Calif.
AH	Hughes Products Division of Hughes Aircraft Co., Newport Beach, Calif.
AJ	International Resistance Co., Philadelphia, Pa.
AK	Jan Hardware Mfg. Co., Inc., Long Island City, N. Y.
AL	JBT Instruments Inc., New Haven, Conn.
AM	Kenyon Transformer Co., Inc., Jersey City, N. J.
AN	Kurman Electric Co., Inc., Brooklyn, N. Y.
AP	Littelfuse, Inc., Des Plaines, Ill.
AQ	Mallory Battery Co., North Tarrytown, N. Y.
AR	Metex Electronics Corporation, Clark, N. J.
AS	James Millen Mfg. Co., Inc., Malden, Mass.
AT	J. W. Miller Co., Los Angeles, Calif.
AU	Military Specifications
AV	Military Standards
AW	Minor Rubber Co., Inc., Bloomfield, N. J.
AX	Micro Switch Div., Minneapolis-Honeywell Regulator Co., Freeport, Ill.
AY	New Departure Division of General Motors Corp., Bristol, Conn.
AZ	Ohmite Mfg. Co., Skokie, Ill.
BA	Patton MacGuyer Co., Providence, R. I.
BB	Parker Kalon Division of General American Transportation Corp., Clifton, N. J.
BC	Pic Design Corp., East Rockaway, N. Y.

TABLE 6-1. MANUFACTURER'S CODE (CONT'D)

CODE	NAME AND ADDRESS
BD	Plastic Capacitors, Inc., Chicago, Ill.
BE	Polarad Electronics Corp., Long Island City, N.Y.
BF	Potter and Brumfield Division of American Machine and Foundry Co., Princeton, Ind.
BG	Pyramid Electric Co., Darlington, S.C.
BH	Raytheon Co., Industrial Components Division, Industrial Tube Operation, Newton, Mass.
BJ	RCA Semiconductor and Materials Division of Radio Corp. of America, Somerville, N.J.
BK	Ripley Co., Inc., Middletown, Conn.
BL	Sangamo Electric Co., Springfield, Ill.
BM	Shakeproof Division of Illinois Tool Works, Elgin, Ill.
BN	Sprague Electric Co., North Adams, Mass.
BP	Staver Co., Inc., Bay Shore, Long Island, N.Y.
BQ	Sterling Transformer Corp., Brooklyn, N.Y.
BR	Technitrol Engineering Co., Philadelphia, Pa.
BS	Telewave Laboratories, Inc., Long Island City, N.Y.
BT	Times Facsimile Corp., New York, N.Y.
BU	Transitron Electronic Corp., Wakefield, Mass.
BV	Ucinite Co., Newtonville, Mass.
BW	United Transformer Co., New York, N.Y.
BX	Utah Radio Products Corp., Huntington, Ind.
BY	Vector Mfg. Co., Houston, Tex.
BZ	Victory Engineering Corp., Springfield, N.J.
CA	Waldes Kohinoor, Inc., Long Island City, N.Y.
CB	Weckesser Co., Chicago, Ill.
CC	Winchester Electronics Co., Inc., Norwalk, Conn.
CD	Cutler-Hammer, Inc., Milwaukee, Wis.
CE	Olsen Machine and Tool Co., North Abington, Mass.
CF	Cannon Electric Co., Los Angeles, Calif.
CG	Arco Electronics, Inc., Great Neck, N.Y.
CH	Cambridge Thermionic Corp., Cambridge, Mass.
CJ	Sylvania Electric Products, Inc., Semiconductor Division, Woburn, Mass.
CK	Commercially Available Component
CL	Stackpole Carbon Co., St. Marys, Pa.
CM	Astron Co., East Newark, N.J.
CN	Sarkes Tarzian, Inc., Bloomington, Ind.
CP	Arrow Hart and Hegeman Electric Co., Hartford, Conn.
CQ	Radio Corp. of America, New York, N.Y.
CR	Allied Control Co., Inc., New York, N.Y.
CS	Sylvania Electric Products, Inc., New York, N.Y.
CT	Leach Corp., Leach Relay Co. Division, Los Angeles, Calif.
CU	Triplett Electrical Instrument Co., Bluffton, Ohio
CV	Bliley Electric Co., Inc., Erie, Pa.
CW	Switchcraft, Inc., Chicago, Ill.
CX	Industrial Products Co., Division of Amphenol-Borg Electronics Corp., Danbury, Conn.
CY	Mepco Division of Sessions Clock Co., Morristown, N.J.
CZ	Resistance Products Co., Harrisburg, Pa.
DA	Continental-Wirt Electronics Corp., Philadelphia, Pa.
DB	Ward Leonard Electric Co., Mount Vernon, N.Y.
DC	Superex Electronics Corp., Yonkers, N.Y.
DD	Oak Mfg. Co., Crystal Lake, Ill.
DE	National Radio Co., Inc., Malden, Mass.

TABLE 6-1. MANUFACTURER'S CODE (CONT'D)

CODE	NAME AND ADDRESS
DF	Wright Electronics, Inc., Kansas City, Mo.
DG	Torrington Mfg. Co., Torrington, Conn.
DH	Union Electronics, Long Island City, N.Y.
DJ	Applied Research, Inc., Port Washington, N.Y.
DK	Ferroxcube Corp. of America, Saugerties, N.Y.
DL	Technology Instrument Corp., Acton, Mass.
DM	Allen B. DuMont Laboratories, Inc., New York, N.Y.
DN	Amperex Electronic Co., Division of North American Philips Co., Inc., Hicksville, N.Y.
DP	Industrial Condenser Corp., Chicago, Ill.
DQ	International Rectifier Corp., El Segundo, Calif.
DR	CTS Corp., Elkhart, Ind.
DS	General Radio Co., West Concord, Mass.
DT	Microlab, Inc., Livingston, N.J.
DU	Comar Electric Co., Chicago, Ill.
DV	Film Capacitors, Inc., New York, N.Y.
DW	FXR Division of Amphenol-Borg Electronics Corp., Danbury, Conn.
DX	Britton Electronics Corp., Mount Vernon, N.Y.
DY	Chicago Standard Transformer Corp., Chicago, Ill.
DZ	P. R. Mallory and Co., Inc., Indianapolis, Ind.
EA	Automatic Metal Products Co., Brooklyn, N.Y.
EB	Dale Electronics, Inc., Columbus, Nebr.
EC	Gulton Industries, Inc., Metuchen, N.J.
ED	International Electronic Industries, Inc., Nashville, Tenn.
EE	Clairtron Mfg. Co., Orange, N.J.
EF	Technical Apparatus Builders, New York, N.Y.
EG	Bussmann Fuse Division of McGraw-Edison Co., St. Louis, Mo.
EH	The Superior Electric Co., Bristol, Conn.
EJ	Rotron Mfg. Co., Inc., Woodstock, N.Y.
EK	Jeffers Electronics Division of Speer Carbon Co., DuBois, Pa.
EL	JFD Electronics Corp., Brooklyn, N.Y.
EM	Essex Electronics Division of Nytronics Inc., Berkeley Heights, N.J.
EN	Torotel, Inc., Kansas City, Mo.
EP	Texas Instruments Inc., Dallas, Texas
EQ	Wells Electronics Co., South Bend, Ind.
ER	Thordarson-Meissner Division of Maguire Industries, Inc., Mount Carmel, Ill.
ES	Piezo Crystal Co., Carlisle, Pa.
ET	Pacific Semiconductors, Inc., Hawthorne, Calif.
EV	Fasco Industries, Inc., Rochester, N.Y.
EW	Triad Transformer Corp., Venice, Calif.
EX	National Tel Tronics Corp., Yonkers, N.Y.
EY	Carling Electric, Inc., Hartford, Conn.
EZ	E.F. Johnson Co., Waseca, Minn.
FA	Thomas Electronics, Inc., Passaic, N.J.
FB	Merit Coil and Transformer Corp., Hollywood, Fla.
FC	Aladdin Electronics Division of Aladdin Industries, Inc., Nashville, Tenn.
FD	Kulka Electric Corp., Mount Vernon, N. Y.
FE	Sperry Semiconductor Division of Sperry Rand Corp., Norwalk, Conn.
FF	Corning Glass Works, Electronic Components Department, Bradford, Pa.
FG	Duncan Electronics, Inc., Santa Ana, Calif.
FH	Advance Electronics Laboratories, Inc., Passaic, N.J.

TABLE 6-1. MANUFACTURER'S CODE (CONT'D)

CODE	NAME AND ADDRESS
FJ	Fastex Division of Illinois Tool Works, Des Plaines, Ill.
FK	Motorola, Inc., Semiconductor Products Division, Phoenix, Ariz.
FL	Electro Motive Mfg. Co., Willimantic, Conn.
FM	Varian Associates, Palo Alto, Calif.
FN	Quality Components, Inc., St. Marys, Pa.
FP	Automatic Mfg. Corp., Newark, N.J.
FQ	Electra Mfg. Co., Kansas City, Mo.
FR	Dage Electric Co., Inc., Beech Grove, Ind.
FS	The Cornish Wire Co., New York, N.Y.
FT	RLC Electronics, Inc., Mamaroneck, N.Y.
FU	Fairchild Camera and Instrument Corp., Semiconductor Division, Mountain View, Calif.
FV	Burnell and Co., Inc., Pelham Manor, N.Y.
FW	Dearborn Electronic Laboratories, Inc., Orlando, Fla.
FX	Weston Instruments, Division of Daystrom, Inc., Newark, N.J.
FY	HI-Q Division of Aerovox Corp., Myrtle Beach, S.C.
FZ	Electric Regulator Corp., South Norwalk, Conn.
GA	Simpson Electric Co., Chicago, Ill.
GB	Control Switch Division, Controls Co. of America, Chicago, Ill.
GC	Semicon, Inc., Bedford, Mass.
GD	Filtron Co., Inc., Flushing, Long Island, N.Y.
GE	Rotating Components, Inc., Brooklyn, N.Y.
GF	Transco Products, Inc., Los Angeles, Calif.
GG	Thompson Ramo Wooldridge, Inc., Cleveland, Ohio
GH	PRD Electronics, Inc., Brooklyn, N.Y.
GJ	Solitron Devices, Inc., Norwood, N.J.
GK	Valpey Crystal Co., Holliston, Mass.
GL	Sage Laboratories, Inc., Natick, Mass.
GM	J.H. Williams and Co., Buffalo, N.Y.
GN	Kings Electronics Co., Inc., Tuckahoe, N.Y.
GP	ITT Federal Division of International Telephone and Telegraph Corp., Clifton, N.J.
GQ	Herman H. Smith, Inc., Brooklyn, N.Y.
GR	Leecraft Mfg. Co., Inc., New York, N.Y.
GS	Adel Division of General Metals Corp., Huntington, W. Va.
GT	Augat Bros., Inc., Attleboro, Mass.
GU	Master Specialties Co., Los Angeles, Calif.
GV	Radio Cores, Inc., Oak Lawn, Ill.
GW	Camloc Fastener Corp., Paramus, N. J.
GX	Zierick Mfg. Corp., New Rochelle, N. Y.
GY	Phelps Dodge Copper Products Corp., Inca Mfg. Division, Fort Wayne, Ind.
GZ	Tung-Sol Electric, Inc., Newark, N. J.
HA	General Ceramics Corp., Keasbey, N. J.
HB	Southco Division of South Chester Corp., Lester, Pa.
HC	Heyman Mfg. Co., Kenilworth, N. J.
HD	International Electronic Research Corp., Burbank, Calif.
HE	Technitrol Engineering Co., Philadelphia, Pa.
HF	Polyphase Instrument Co., Bridgeport, Montgomery County, Pa.
HG	General Electric Co., Receiving Tube Department of Electronic Components Division, Clifton, N. J.
HH	Alpha Wire Corp., New York, N. Y.
HJ	Metal Textile Corp., Roselle, N. J.
HK	Speer Resistor Division of Speer Carbon Co., Bradford, Pa.

TABLE 6-1. MANUFACTURER'S CODE (CONT'D)

CODE	NAME AND ADDRESS
HL	Curtiss-Wright Corp., Electronics Division, East Patterson, N. J.
HM	Mueller Electric Co., Cleveland, Ohio
HN	Bergen Laboratories, Patterson, N. J.
HP	Sherold Crystals, Inc., Kansas City, Mo.
HQ	Hewlett-Packard Co., Palo Alto, Calif.
HR	Keystone Electronics Corp., New York, N. Y.
HS	Hupp Electronics, Division of Hupp Corp., Forest Park, Ill.
HT	Continental Connector Corp., Division of De Jur Amsco Corp., Long Island City, N. Y.
HU	Arnold Stevens Co., Inc., Boston, Mass.
HV	Grant Pulley and Hardware Co., West Nyack, N. Y.
HW	Filmohm Corp., New York, N. Y.
HX	Freed Transformer Co., Brooklyn, N. Y.
HY	Trimm, Inc., Libertyville, Ill.
HZ	Minneapolis Honeywell Regulator Co., Precision Meter Division, Manchester, N. H.
JA	Edwin B. Stimpson Co., Inc., Brooklyn, N. Y.
JB	Burndy Corp., Norwalk, Conn.
JC	Bradley Industries, Chicago, Ill.
JD	Aemco, Inc., Mankato, Minn.
JE	Molon Motors and Coil Corp., Chicago, Ill.
JF	Beckman Instruments, Inc., Fullerton, Calif.
JG	National Lock Washer Co., Newark, N. J.
JH	Tinnerman Products, Inc., Cleveland, Ohio
JJ	General Instrument Corp., Semiconductor Division, Newark, N. J.
JK	Vector Electronic Co., Glendale, Calif.
JL	Western Electric Co., Inc., New York, N. Y.
JM	Amp, Inc., Harrisburg, Pa.
JN	G. C. Electronics Mfg. Co., Rockford, Ill.
JP	Redmond Co., Inc., Owosso, Mich.
JQ	Philadelphia Handle Co., Camden, N. J.
JR	Gremar Mfg. Co., Inc., Wakefield, Mass.
JS	Monadnock Mills, San Leandro, Calif.
JT	Instrument Specialties Co., Inc., Little Falls, N. J.
JU	Connecticut Hard Rubber Co., New Haven, Conn.
JV	Veeder Root, Inc., Hartford, Conn.
JW	Beemer Engineering Co., Philadelphia, Pa.
JX	Breeze Corporation, Inc., Union, N. J.
JY	Remler Co., Ltd., San Francisco, Calif.
JZ	TA Mfg. Corp., Los Angeles, Calif.
KA	Sigma Instruments, Inc., South Braintree, Mass.
KB	Standard Transformer Corp., Chicago, Ill.
KC	Thomson Industries, Inc., Long Island City, N. Y.
KD	United Electronics Co., Newark, N. J.
KE	U. S. Engineering Co., Long Island City, N. Y.

TABLE 6-2. PARTS LIST

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
	TR BASIC UNIT			
A1	POWER INVERTER ASSY	C146960	BE	1
A2	SHIELD AND TERMINAL ASSY	C147010	BE	1
A3	FRONT PANEL ASSY	D142064	BE	1
A100	AMPLIFIER,IF,140MC TO 40MC	D137799	BE	1
A200	AMPLIFIER,IF,LOW NOISE	D141506	BE	1
A300	OSCILLATOR,RF,LOCAL	D141019	BE	1
A400	AMPLIFIER,IF,40MC	D141495	BE	1
A500	AMPLIFIER,DETECTOR,FM	D141492	BE	1
A600	AUDIO OSCILLATOR AND AMPLIFIER ASSY	D142557	BE	1
A700	AMPLIFIER,ELECTRONIC CONTROL AND MULTIMETER	D145310	BE	1
A800	POWER SUPPLY,KLYSTRON	E145226	BE	1
A801	COMPONENT ASSY,PART OF A800	C145053	BE	1
A802	COMPONENT ASSY,PART OF A800	C145021	BE	1
A803	SEMICONDUCTOR DEVICE ASSY	B145037	BE	1
A4200	FILTER ASSY,BAND-PASS,40MC AND 140MC	D145971	BE	1
A4201	FILTER ASSY,BAND-PASS,40MC	D142847	BE	1
A4202	COMPONENT ASSY	D144454	BE	1
A4500	FILTER,HIGH-PASS,255MC	C143838	BE	1
B1	NOT USED			
B2	FAN,AXIAL,115VAC,60CPS	B702227	BE	1
CR1	NOT USED			
CR2	SEMICONDUCTOR DEVICE,DIODE,SILICON	1N1217	CK	5
CR101	SEMICONDUCTOR DEVICE,DIODE,CRYSTAL	1N198	CK	15
CR201	SEMICONDUCTOR DEVICE,DIODE,CRYSTAL	1N82	CK	5
CR401	NOT USED			
CR402	SEMICONDUCTOR DEVICE,DIODE /POLARAD PART NO. A702854	FD100	FU	5
CR501 AND CR502	SEMICONDUCTOR DEVICE,DIODE,CRYSTAL	1N251	CK	5
CR503 AND CR504	SAME AS CR101			
CR701	SEMICONDUCTOR DEVICE,DIODE	1N690	CK	5
CR702 AND CR703	SEMICONDUCTOR DEVICE,DIODE	1N816	CK	20
CR801 THRU CR804	SEMICONDUCTOR DEVICE,DIODE	1N3208	CK	20

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
CR805	NOT USED			
CR806	SEMICONDUCTOR DEVICE,DIODE	1N1929	CK	10
CR807 AND CR808	SEMICONDUCTOR DEVICE,DIODE,SILICON	1N2069	CK	40
CR809	SEMICONDUCTOR DEVICE,DIODE,SILICON	1N2071	CK	50
CR810	SAME AS CR702			
CR811 THRU CR813	SAME AS CR809			
CR814 THRU CR816	SAME AS CR807			
CR817	SAME AS CR806			
CR818 AND CR819	SAME AS CR809			
CR820	SAME AS CR702			
CR821 THRU CR824	SAME AS CR809			
CR825 AND CR826	NOT USED			
CR827	SAME AS CR807			
CR828 THRU CR830	NOT USED			
CR831	SEMICONDUCTOR DEVICE,DIODE /POLARAD PART NO. A704589	1M25Z5	FK	5
CR832	NOT USED			
CR833	SAME AS CR807			
CR834 THRU CR837	NOT USED			
CR838 AND CR839	SEMICONDUCTOR DEVICE,DIODE	1N3001B	CK	5
CR840	NOT USED			
CR841	SEMICONDUCTOR DEVICE,DIODE	1N2976B	CK	5
CR842 AND CR843	SAME AS CR807			
CR844	SEMICONDUCTOR DEVICE,DIODE	1N2986B	CK	5
CR845	NOT USED			
CR846	SAME AS CR807			
CR847	SEMICONDUCTOR DEVICE,DIODE	1N3016B	CK	10
CR848	SEMICONDUCTOR DEVICE,DIODE	1N538	CK	5
CR849	SEMICONDUCTOR DEVICE,DIODE	1N625	CK	5
CR850	NOT USED			
CR851	SAME AS CR847			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
C1	CAPACITOR,ELECTROLYTIC,50UF,PLUS 100 PCT, MINUS 10 PCT,50WVDC/POLARAD PART NO. B704634	30D200A1	BN	1
C2	CAPACITOR,ELECTROLYTIC,25UF,PLUS 100 PCT, MINUS 10 PCT,15WVDC/POLARAD PART NO. B704640	30D168A1	BN	1
C3 AND C4	CAPACITOR,ELECTROLYTIC,100UF,PLUS 100 PCT, MINUS 10 PCT,25WVDC/POLARAD PART NO. B704638	30D188A1	BN	2
C5	CAPACITOR,PLASTIC,1UF,10 PCT,200WVDC /POLARAD PART NO. B508735	2TM-M10	BN	1
C101	CAPACITOR,CERAMIC,1000UUF,10 PCT,1000WVDC /POLARAD PART NO. A701560	DD-102	P	1
C102 AND C103	CAPACITOR,CERAMIC,1000UUF,20 PCT,500WVDC /POLARAD PART NO. A701509	SB2A-102W	D	4
C104	NOT USED			
C105	CAPACITOR,VARIABLE,CERAMIC,2-12UUF,10 PCT, 500WVDC/POLARAD PART NO. A701519	PCST-50	CH	1
C106 AND C107	SAME AS C102			
C108	NOT USED			
C109	SAME AS C102			
C110	SAME AS C105			
C111	SAME AS C102			
C112	NOT USED			
C113 THRU C115	SAME AS C102			
C116	NOT USED			
C117	SAME AS C105			
C118 AND C119	SAME AS C102			
C120	NOT USED			
C121	SAME AS C102			
C122	SAME AS C105			
C123	SAME AS C102			
C124	NOT USED			
C125 AND C126	SAME AS C102			
C127	SAME AS C105			
C128	NOT USED			
C129 THRU C131	SAME AS C102			
C132	NOT USED			
C133	SAME AS C105			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
C134 AND C135	SAME AS C102			
C136	NOT USED			
C137 AND C138	SAME AS C102			
C139	SAME AS C105			
C140	NOT USED			
C141	SAME AS C102			
C142	NOT USED			
C143	SAME AS C102			
C144	NOT USED			
C145	SAME AS C102			
C146	SAME AS C101			
C147	CAPACITOR,MICA,39UUF,10 PCT,500WVDC /POLARAD PART NO. B703020	DM15E390K	FL	1
C148	CAPACITOR,VARIABLE,CERAMIC,0.5-4.5UUF,10 PCT, 500WVDC/POLARAD PART NO. A701518	PCST-6	CH	1
C201 AND C202	SAME AS C102			
C203	SAME AS C105			
C204	CAPACITOR,CERAMIC,470UUF,PLUS 100 PCT, MINUS 20 PCT,500WVDC	CK60Y471Z	AU	1
C205	NOT USED			
C206 THRU C209	SAME AS C102			
C210	NOT USED			
C211 AND C212	SAME AS C102			
C213 THRU C215	NOT USED			
C216	SAME AS C102			
C217	NOT USED			
C218	CAPACITOR,CERAMIC,10UUF,5 PCT,500WVDC	CC20CH100J	AU	1
C219	CAPACITOR,CERAMIC,4UUF,0.25UUF TOL,500WVDC	CC20CH040C	AU	1
C220	NOT USED			
C221	CAPACITOR,CERAMIC,820UUF,PLUS 100 PCT, MINUS 20 PCT,500WVDC	CK60Y821Z	AU	1
C222	NOT USED			
C223	SAME AS C221			
C224	CAPACITOR,CERAMIC,1000UUF,10 PCT,500WVDC /POLARAD PART NO. B706391	FT3-102W	D	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
C225	NOT USED			
C226	SAME AS C102			
C227	SAME AS C224			
C228	SAME AS C102			
C229	SAME AS C224			
C230	NOT USED			
C231	SAME AS C224			
C232	CAPACITOR,CERAMIC,1UUF,0.25UUF TOL,500WVDC	CC20CK010C	AU	1
C233	SAME AS C148			
C234	CAPACITOR,CERAMIC,1.5UUF,0.25UUF TOL,500WVDC	CC20CK1R5C	AU	1
C235	NOT USED			
C236	SAME AS C105			
C237	SAME AS C148			
C238	CAPACITOR,CERAMIC,2UUF,0.25UUF TOL,500WVDC	CC20CK020C	AU	1
C301	NOT USED			
C302	SAME AS C147			
C303 THRU C305	SAME AS C102			
C306	CAPACITOR,CERAMIC,18UUF,5 PCT,500WVDC	CC20CH180J	AU	1
C307	SAME AS C102			
C308	CAPACITOR,MICA,15UUF,10 PCT,500WVDC /POLARAD PART NO. B703011	DM15C150K	FL	1
C309	SAME AS C102			
C310	NOT USED			
C311	CAPACITOR,MICA,820UUF,10 PCT,300WVDC /POLARAD PART NO. B703055	DM15F821K	FL	1
C312 AND C313	SAME AS C102			
C314	SAME AS C105			
C315 AND C316	SAME AS C102			
C317	SAME AS C311			
C318	SAME AS C105			
C319 AND C320	SAME AS C102			
C321	CAPACITOR,TANTALYTIC,10UF,20 PCT,15WVDC /POLARAD PART NO. B704780	150D106X0015B2	BN	1
C322	CAPACITOR,ELECTROLYTIC,50UF,PLUS 100 PCT, MINUS 10 PCT,15WVDC/POLARAD PART NO. B704643	30D170A1	BN	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
C323 THRU C326	SAME AS C105			
C327 AND C328	SAME AS C102			
C329	CAPACITOR,CERAMIC,8UUF,0.5UUF TOL,500WVDC	CC20CH080D	AU	1
C330	SAME AS C102			
C331	SAME AS C105			
C332	NOT USED			
C333	SAME AS C102			
C334	CAPACITOR,MICA,12UUF,10 PCT,500WVDC /POLARAD PART NO. B703010	DM15C120K	FL	1
C335	NOT USED			
C336	SAME AS C102			
C337 THRU C339	NOT USED			
C340 THRU C342	CAPACITOR,CERAMIC,2.2UUF,0.25UUF TOL,500WVDC	CC20CK2R2C	AU	1
C343	CAPACITOR,CERAMIC,3.3UUF,0.25UUF TOL,500WVDC	CC20CK3R3C	AU	1
C344	CAPACITOR,CERAMIC,5UUF,0.25UUF TOL,500WVDC	CC20CJ050C	AU	1
C345 AND C346	CAPACITOR,MICA,150UUF,5 PCT,300WVDC	CM15E151J	AU	1
C347	CAPACITOR,ELECTROLYTIC,3UF,PLUS 100 PCT, MINUS 10 PCT,12WVDC/POLARAD PART NO. B704644	30D142A1	BN	1
C401	CAPACITOR,CERAMIC,2000UUF,10 PCT,500WVDC /POLARAD PART NO. B704888	BCD-D1-4	FY	1
C402 AND C403	SAME AS C102			
C404	CAPACITOR,VARIABLE,GLASS,0.7-12UUF,1000WVDC /POLARAD PART NO. B702812	VC22G	EL	1
C405	SAME AS C102			
C406	NOT USED			
C407 THRU C409	SAME AS C102			
C410	SAME AS C344			
C411	SAME AS C404			
C412	NOT USED			
C413	SAME AS C102			
C414	SAME AS C401			
C415	SAME AS C102			
C416	CAPACITOR,CERAMIC,4700UUF,PLUS 100 PCT, MINUS 20 PCT,500WVDC	CK62Y472Z	AU	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
C417 AND C418	NOT USED			
C419	SAME AS C102			
C420	NOT USED			
C421	CAPACITOR,VARIABLE,GLASS,0.8-8UUF,1000WVDC /POLARAD PART NO. B702621	VCJ-254A	EL	1
C422 AND C423	CAPACITOR,CERAMIC,1000UUF,10 PCT,500WVDC /POLARAD PART NO. B704887	BCD-D1-2	FY	1
C424	NOT USED			
C425	SAME AS C102			
C426	SAME AS C421			
C427	SAME AS C102			
C428	NOT USED			
C429	CAPACITOR,ELECTROLYTIC,10UF,PLUS 100 PCT, MINUS 10 PCT,15WVDC/POLARAD PART NO. B704636	30D165A1	BN	1
C430	NOT USED			
C431 THRU C433	CAPACITOR,CERAMIC,1000UUF,10 PCT,500WVDC /POLARAD PART NO. B706451	FB2B-102W	D	2
C434	SAME AS C102			
C435 AND C436	SAME AS C431			
C437	SAME AS C344			
C438	NOT USED			
C439	SAME AS C431			
C440	NOT USED			
C441	SAME AS C431			
C442	SAME AS C102			
C443	NOT USED			
C444	SAME AS C431			
C445	NOT USED			
C446	CAPACITOR,ELECTROLYTIC,50UF,PLUS 100 PCT, MINUS 10 PCT,25WVDC/POLARAD PART NO. B704637	30D186A1	BN	1
C447	CAPACITOR,CERAMIC,8UUF,0.25UUF TOL,500WVDC	CC20CJ080C	AU	1
C448	SAME AS C238			
C449	CAPACITOR,VARIABLE,CERAMIC,3-25UUF,500WVDC /POLARAD PART NO. B704605	PCS6-50	CH	1
C450	NOT USED			
C451	SAME AS C344			
C501	CAPACITOR,CERAMIC,2000UUF,10 PCT,1000WVDC /POLARAD PART NO. B705178	DD-202	P	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
C502	CAPACITOR,CERAMIC,6UUF,0.25UUF TOL,500WVDC	CC20CH060C	AU	1
C503 AND C504	CAPACITOR,CERAMIC,1000UUF,GMV,500WVDC, WITH LOCKWASHER M6347 AND NUT M6369 /POLARAD PART NO. B706421	SB4A-102W	D	2
C505	NOT USED			
C506	SAME AS C503			
C507	SAME AS C404			
C508 AND C509	SAME AS C503			
C510	NOT USED			
C511	CAPACITOR,CERAMIC,3UUF,0.25UUF TOL,500WVDC	CC20CJ030C	AU	1
C512 AND C513	SAME AS C503			
C514	CAPACITOR,VARIABLE,CERAMIC,7-35UUF,600WVDC /POLARAD PART NO. B702233	827D	P	1
C515	NOT USED			
C516	CAPACITOR,CERAMIC,7UUF,0.25UUF TOL,500WVDC	CC20CH070C	AU	1
C517 AND C518	SAME AS C503			
C519	SAME AS C404			
C520	NOT USED			
C521 AND C522	CAPACITOR,CERAMIC,10UUF,0.5UUF TOL,500WVDC	CC20UJ100D	AU	1
C523 AND C524	CAPACITOR,CERAMIC,15UUF,2 PCT,500WVDC	CC20CH150G	AU	1
C525	NOT USED			
C526	SAME AS C503			
C527	CAPACITOR,TANTALYTIC,4.7UF,10 PCT,20WVDC /POLARAD PART NO. B704779	150D475X9020B2	BN	1
C528	SAME AS C431			
C529	SAME AS C527			
C530 THRU C533	SAME AS C431			
C601	SAME AS C2			
C602	CAPACITOR,ELECTROLYTIC,50UF,PLUS 100 PCT, MINUS 10 PCT,6WVDC/POLARAD PART NO. B704629	30D133A1	BN	1
C603	NOT USED			
C604	CAPACITOR,ELECTROLYTIC,25UF,PLUS 100 PCT, MINUS 10 PCT,12WVDC/POLARAD PART NO. B704631	30D150A1	BN	1
C605	CAPACITOR,CERAMIC,1000UUF,PLUS 100 PCT, MINUS 20 PCT,500WVDC	CK61Y102Z	AU	1
C606	SAME AS C604			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
C607	CAPACITOR,ELECTROLYTIC,1UF,PLUS 100 PCT, MINUS 10 PCT,12WVDC/POLARAD PART NO. B704632	30D140A1	BN	1
C608	CAPACITOR,TANTALYTIC,1.5UF,20 PCT,20WVDC /POLARAD PART NO. B704778	150D155X0020A2	BN	1
C609	CAPACITOR,TANTALYTIC,0.56UF,10 PCT,15WVDC /POLARAD PART NO. B704777	150D564X9015A2	BN	1
C610	NOT USED			
C611	CAPACITOR,ELECTROLYTIC,20UF,PLUS 100 PCT, MINUS 10 PCT,50WVDC/POLARAD PART NO. B704633	30D198A1	BN	1
C612	SAME AS C2			
C613	NOT USED			
C614	CAPACITOR,PLASTIC,0.01UF,20 PCT,100WVDC /POLARAD PART NO. B703733	WMF1S1E	U	1
C615	NOT USED			
C616	CAPACITOR,ELECTROLYTIC,5UF,PLUS 100 PCT, MINUS 10 PCT,25WVDC/POLARAD PART NO. B704639	30D179A1	BN	1
C617	CAPACITOR,ELECTROLYTIC,5UF,PLUS 100 PCT, MINUS 10 PCT,15WVDC/POLARAD PART NO. B704630	30D162A1	BN	1
C701	NOT USED			
C702	CAPACITOR,PAPER,0.01UF,10 PCT,400WVDC	CP05A1EE103K	AU	1
C703 AND C704	CAPACITOR,PAPER,0.047UF,10 PCT,400WVDC	CP04A1EE473K	AU	1
C801	CAPACITOR,ELECTROLYTIC,16000UF,PLUS 100 PCT, MINUS 10 PCT,20WVDC/POLARAD PART NO. B706257	32D2087T	BN	1
C802 THRU C806	NOT USED			
C807	CAPACITOR,ELECTROLYTIC,150UF,PLUS 100 PCT, MINUS 10 PCT,15WVDC/POLARAD PART NO. B704641	30D173A1	BN	1
C808	CAPACITOR,ELECTROLYTIC,10UF,PLUS 100 PCT, MINUS 10 PCT,50WVDC/POLARAD PART NO. B705085	40D193A2	BN	1
C809	CAPACITOR,PAPER,DUAL SECT,1UF,10 PCT, 600WVDC,BOTH SECT	CP54B4EF105K	AU	1
C810 AND C811	NOT USED			
C812	CAPACITOR,PAPER,0.5UF,10 PCT,1000WVDC	CP53B1EG504K	AU	1
C813	SAME AS C808			
C814	NOT USED			
C815	SAME AS C812			
C816	SAME AS C808			
C817 AND C818	CAPACITOR,PAPER,1UF,10 PCT,1000WVDC	CP53B1EG105K	AU	1
C819	SAME AS C1			
C820	NOT USED			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
C821	CAPACITOR,ELECTROLYTIC,8UF,10 PCT,450WVDC /POLARAD PART NO. B703544	BR8-450	U	1
C822	NOT USED			
C823 AND C824	CAPACITOR,PAPER,1UF,20 PCT,1500WVDC /POLARAD PART NO. B705804	CMLB105M15	FW	1
C825	NOT USED			
C826 AND C827	SAME AS C1			
C828	SAME AS C3			
C829 AND C830	NOT USED			
C831 THRU C833	SAME AS C3			
C834 AND C835	SAME AS C1			
C836	NOT USED			
C837	CAPACITOR,ELECTROLYTIC,1000UF,PLUS 100 PCT, MINUS 10 PCT,25WVDC/POLARAD PART NO. B706226	32D3090T	BN	1
C4201	CAPACITOR,MICA,20UUF,5 PCT,500WVDC /POLARAD PART NO. B705001	DM10C200J	FL	1
C4202	CAPACITOR,VARIABLE,CERAMIC,4.5-25UUF,500WVDC	CV11A250	AU	1
C4203	CAPACITOR,VARIABLE,CERAMIC,1.5-7UUF,500WVDC	CV11A070	AU	1
C4204	SAME AS C4202			
C4205	SAME AS C4201			
C4206	CAPACITOR,CERAMIC,6.8UUF,0.25UUF TOL,500WVDC	CC20CH6R8C	AU	1
C4207	CAPACITOR,VARIABLE,CERAMIC,4-30UUF,500WVDC	CV11D300	AU	1
C4208	CAPACITOR,MICA,68UUF,10 PCT,500WVDC /POLARAD PART NO. B703027	DM15F680K	FL	1
C4209	SAME AS C4203			
C4210	NOT USED			
C4211	SAME AS C4208			
C4212	SAME AS C4207			
C4213	SAME AS C4206			
C4214	SAME AS C605			
C4215	SAME AS C503			
C4216	SAME AS C605			
C4217	SAME AS C105			
C4218	CAPACITOR,CERAMIC,20UUF,2 PCT,500WVDC	CC20CH200G	AU	1
C4219	SAME AS C421			
C4220	NOT USED			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
C4221	SAME AS C4218			
C4222	CAPACITOR,CERAMIC,3UUF,0.25UUF TOL,500WVDC	CC20CH030C	AU	1
C4223	CAPACITOR,CERAMIC,43UUF,5 PCT,500WVDC	CC30CH430J	AU	1
C4224	SAME AS C421			
C4225	NOT USED			
C4226	SAME AS C4223			
C4227	SAME AS C4222			
C4228 AND C4229	SAME AS C105			
C4501	SAME AS C514			
C4502 AND C4503	SAME AS C105			
C4504	SAME AS C514			
C4505	SAME AS C105			
C4506	SAME AS C503			
DS1 THRU DS4	LAMP,INCANDESCENT/POLARAD PART NO. B705201	330	Z	7
FL1	FILTER,RADIO INTERFERENCE /POLARAD PART NO. B701770	FA4931A	GD	1
FL101 THRU FL104	FILTER,RF,LOW-PASS,FEED-THRU,200V, WITH LOCKWASHER M6351 AND NUT M6377 /POLARAD PART NO. A701510	SMFB-A2	D	1
FL201	SAME AS FL101			
FL301 AND FL302	SAME AS FL101			
FL4201	SAME AS FL101			
F1 AND F2	FUSE,4 AMP,3AG/POLARAD PART NO. 518140	F02G4R00A	AU	10
F3 AND F4	FUSE,20 AMP/POLARAD PART NO. A704162	SFE-20	EG	10
H1 THRU H3	KNOB/POLARAD PART NO. 517221	70-2-2G	BH	1
H4	KNOB/POLARAD PART NO. 507407	70-5-2G	BH	1
H5 THRU H10	NOT USED			
H11 AND H12	SAME AS H4			
J1 AND J2	CONNECTOR,RECEPTACLE,FEMALE,CENTER CONTACT /POLARAD PART NO. B707477	100-T3000-75	EA	1
J3	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE	UG-1094/U	AU	1
J4 AND J5	CONNECTOR,RECEPTACLE,FEMALE,TELEPHONE TYPE	JJ-089	AU	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
J6	NOT USED			
J7	CONNECTOR,BINDING POST,RED /POLARAD PART NO. B703682	DF30RC	EH	1
J8	CONNECTOR,BINDING POST,BLACK /POLARAD PART NO. B703681	DF30BC	EH	1
J101 THRU J103	CONNECTOR,RECEPTACLE,FEMALE,BSM TYPE /POLARAD PART NO. A701522	RF-0750	EA	2
J104	CONNECTOR,RECEPTACLE,FEMALE,8 PINS /POLARAD PART NO. B704845	MRE5-3S-N	CC	1
J201 THRU J203	SAME AS J101			
J204	SAME AS J104			
J301 AND J302	SAME AS J101			
J303	CONNECTOR,RECEPTACLE,FEMALE,4 PINS /POLARAD PART NO. C509738	M4S-LRGN	CC	1
J401 AND J402	SAME AS J101			
J403 AND J404	NOT USED			
J405	SAME AS J104			
J406	SAME AS J101			
J501	SAME AS J101			
J502	NOT USED			
J503	SAME AS J104			
J601	SAME AS J104			
J701	CONNECTOR,RECEPTACLE,FEMALE,20 PINS /POLARAD PART NO. A701469	MRA-20S-G	CC	1
J702	SAME AS J101			
J801	CONNECTOR,RECEPTACLE,FEMALE,34 PINS /POLARAD PART NO. A701496	MRA-34S-G	CC	1
J907	CONNECTOR,RECEPTACLE,FEMALE,14 PINS /POLARAD PART NO. B701693	MRA-14S	CC	1
J1101 THRU J1105	NOT USED			
J1106	CONNECTOR,RECEPTACLE,FEMALE,40 PINS /POLARAD PART NO. B703159	DPX-J40C1-33S	CF	1
J1601	CONNECTOR,RECEPTACLE,FEMALE,41 PINS /POLARAD PART NO. B701699	MRA-41S	CC	1
J4201 AND J4202	SAME AS J101			
J4203	SAME AS J303			
J4204 AND J4205	SAME AS J101			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
J4501 AND J4502	SAME AS J101			
K1	NOT USED			
K2	RELAY,ARMATURE,20 AMP,6V /POLARAD PART NO. A702277	261C	AN	1
K801	RELAY,3PDT/POLARAD PART NO. B704266	DOX-51T	AZ	1
K802	RELAY,THERMAL DELAY/POLARAD PART NO. B701179	6N075T	E	1
L1 AND L2	COIL,RF,100MH/POLARAD PART NO. B701885	P50-14-T	EN	1
L101 THRU L103	COIL,RF,4.7UH/POLARAD PART NO. B702559	10102-24	EK	2
L104	COIL,RF,0.33UH/POLARAD PART NO. B702550	10100-24	EK	1
L105 AND L106	SAME AS L101			
L107 THRU L110	NOT USED			
L111	COIL,RF,0.8UH	B145307	BE	1
L201 AND L202	COIL,RF,1.8UH	B146161	BE	1
L203	COIL,RF,VARIABLE	B145245	BE	1
L204	SAME AS L201			
L205	NOT USED			
L206 THRU L209	SAME AS L201			
L210	NOT USED			
L211	SAME AS L201			
L212	COIL,RF,VARIABLE	B145240	BE	1
L213	COIL,RF,5UH	A100676	BE	1
L214 AND L215	NOT USED			
L216 AND L217	SAME AS L213			
L218	SAME AS L111			
L219	COIL,RF,VARIABLE	B145306	BE	1
L220	NOT USED			
L221	COIL,RF	A145308	BE	1
L301	COIL,RF,6.8UH/POLARAD PART NO. B702561	10102-28	EK	1
L302	COIL,RF,0.8UH	B19813	BE	1
L303 AND L304	COIL,RF,5.6UH/POLARAD PART NO. B702560	10102-26	EK	1
L305 AND L306	COIL,RF,3.3UH/POLARAD PART NO. B702557	10102-20	EK	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
L307	COIL•RF•VARIABLE	B145239	BE	1
L308	COIL•RF	B145056	BE	1
L309	COIL•RF	B145054	BE	1
L310	COIL•RF	B145229	BE	1
L311	COIL•RF	B145055	BE	1
L401 THRU L403	COIL•RF•10UH/POLARAD PART NO• B702563	10102-32	EK	1
L404	SAME AS L101			
L405	COIL•RF•VARIABLE•1•65-3•5UH	B145242	BE	1
L406	COIL•RF•VARIABLE•0•95-1•45UH	B145243	BE	1
L407	COIL•RF•VARIABLE•0•55-0•9UH	B145233	BE	1
L408 AND L409	SAME AS L401			
L410	COIL•RF•VARIABLE•1•7-2•6UH	B145244	BE	1
L411	NOT USED			
L412	COIL•RF•0•47UH/POLARAD PART NO• B702551	10100-26	EK	1
L413 THRU L415	NOT USED			
L416	COIL•RF•65UH	B145978	BE	1
L501	COIL•RF•VARIABLE•0•43-0•63UH	B145232	BE	1
L502	SAME AS L101			
L503	NOT USED			
L504	COIL•RF•VARIABLE•0•73UH	B145241	BE	1
L505	NOT USED			
L506 AND L507	SAME AS L101			
L508	COIL•RF•25UH	A27127	BE	1
L509	SAME AS L101			
L601 AND L602	SAME AS L1			
L801	COIL•RF•500MH/POLARAD PART NO• A706303	S-72316TCM-15	FV	1
L802	COIL•RF•500MH	A146479	BE	1
L803 AND L804	COIL•RF•500MH/POLARAD PART NO• B701887	P50-20-T	EN	1
L805	NOT USED			
L806	REACTOR•5MH/POLARAD PART NO• B707455	ST26388	BQ	1
L4201	COIL•RF•0•175UH	A145263	BE	1
L4202	COIL•RF•0•175UH	A145262	BE	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
J4501 AND J4502	SAME AS J101			
K1	NOT USED			
K2	RELAY,ARMATURE,20 AMP,6V /POLARAD PART NO. A702277	261C	AN	1
K801	RELAY,3PDT/POLARAD PART NO. B704266	DOX-51T	AZ	1
K802	RELAY,THERMAL DELAY/POLARAD PART NO. B701179	6N075T	E	1
L1 AND L2	COIL,RF,100MH/POLARAD PART NO. B701885	P50-14-T	EN	1
L101 THRU L103	COIL,RF,4.7UH/POLARAD PART NO. B702559	10102-24	EK	2
L104	COIL,RF,0.33UH/POLARAD PART NO. B702550	10100-24	EK	1
L105 AND L106	SAME AS L101			
L107 THRU L110	NOT USED			
L111	COIL,RF,0.8UH	B145307	BE	1
L201 AND L202	COIL,RF,1.8UH	B146161	BE	1
L203	COIL,RF,VARIABLE	B145245	BE	1
L204	SAME AS L201			
L205	NOT USED			
L206 THRU L209	SAME AS L201			
L210	NOT USED			
L211	SAME AS L201			
L212	COIL,RF,VARIABLE	B145240	BE	1
L213	COIL,RF,5UH	A100676	BE	1
L214 AND L215	NOT USED			
L216 AND L217	SAME AS L213			
L218	SAME AS L111			
L219	COIL,RF,VARIABLE	B145306	BE	1
L220	NOT USED			
L221	COIL,RF	A145308	BE	1
L301	COIL,RF,6.8UH/POLARAD PART NO. B702561	10102-28	EK	1
L302	COIL,RF,0.8UH	B19813	BE	1
L303 AND L304	COIL,RF,5.6UH/POLARAD PART NO. B702560	10102-26	EK	1
L305 AND L306	COIL,RF,3.3UH/POLARAD PART NO. B702557	10102-20	EK	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
L307	COIL•RF•VARIABLE	B145239	BE	1
L308	COIL•RF	B145056	BE	1
L309	COIL•RF	B145054	BE	1
L310	COIL•RF	B145229	BE	1
L311	COIL•RF	B145055	BE	1
L401 THRU L403	COIL•RF•10UH/POLARAD PART NO• B702563	10102-32	EK	1
L404	SAME AS L101			
L405	COIL•RF•VARIABLE•1•65-3•5UH	B145242	BE	1
L406	COIL•RF•VARIABLE•0•95-1•45UH	B145243	BE	1
L407	COIL•RF•VARIABLE•0•55-0•9UH	B145233	BE	1
L408 AND L409	SAME AS L401			
L410	COIL•RF•VARIABLE•1•7-2•6UH	B145244	BE	1
L411	NOT USED			
L412	COIL•RF•0•47UH/POLARAD PART NO• B702551	10100-26	EK	1
L413 THRU L415	NOT USED			
L416	COIL•RF•65UH	B145978	BE	1
L501	COIL•RF•VARIABLE•0•43-0•63UH	B145232	BE	1
L502	SAME AS L101			
L503	NOT USED			
L504	COIL•RF•VARIABLE•0•73UH	B145241	BE	1
L505	NOT USED			
L506 AND L507	SAME AS L101			
L508	COIL•RF•25UH	A27127	BE	1
L509	SAME AS L101			
L601 AND L602	SAME AS L1			
L801	COIL•RF•500MH/POLARAD PART NO• A706303	S-72316TCM-15	FV	1
L802	COIL•RF•500MH	A146479	BE	1
L803 AND L804	COIL•RF•500MH/POLARAD PART NO• B701887	P50-20-T	EN	1
L805	NOT USED			
L806	REACTOR•5MH/POLARAD PART NO• B707455	ST26388	BQ	1
L4201	COIL•RF•0•175UH	A145263	BE	1
L4202	COIL•RF•0•175UH	A145262	BE	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
L4203	SAME AS L412			
L4204	COIL•RF•0.405UH	B145265	BE	1
L4205	COIL•RF•0.405UH	B145264	BE	1
L4206	COIL•RF•VARIABLE	B145972	BE	1
L4207	COIL•RF	A145975	BE	1
L4208	COIL•RF	A145974	BE	1
L4209	COIL•RF•VARIABLE	B145973	BE	1
L4501	COIL•RF	A143359	BE	1
L4502	COIL•RF	A143844	BE	1
L4503	SAME AS L4501			
L4504 AND L4505	SAME AS L302			
M1	AMMETER•100UA	B707088	BE	1
P5	NOT USED			
P6	CONNECTOR•PLUG•MALE•3 PINS• NON-REPLACEABLE PART OF WJ			
P101 THRU P103	CONNECTOR•PLUG•MALE•BSM TYPE /POLARAD PART NO• A701861	CBWT-RF-0721-70	EA	2
P104	CONNECTOR•PLUG•MALE•8 PINS•WITH HOOD MRE-8H /POLARAD PART NO• B704844	MRE5-3P-N	CC	1
P201 AND P202	SAME AS P101			
P203	SAME AS P101			
P204	SAME AS P104			
P301 AND P302	SAME AS P101			
P303	CONNECTOR•PLUG•MALE•4 PINS•WITH HOOD H10C /POLARAD PART NO• C509705	M4P-LS	CC	1
P401 AND P402	SAME AS P101			
P403 AND P404	NOT USED			
P405	SAME AS P104			
P406	SAME AS P101			
P501	SAME AS P101			
P502	NOT USED			
P503	SAME AS P104			
P601	SAME AS P104			
P701	CONNECTOR•PLUG•MALE•20 PINS•WITH HOOD MRE-20H /POLARAD PART NO• A701470	MRA-20P-G	CC	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
P702	SAME AS P101			
P801	CONNECTOR,PLUG,MALE,34 PINS,WITH HOOD MRE-34H /POLARAD PART NO. A701495	MRA-34P-G	CC	1
P1601	CONNECTOR,PLUG,MALE,41 PINS,WITH HOOD MRE-41H /POLARAD PART NO. B701698	MRA-41P	CC	1
P4201 AND P4202	SAME AS P101			
P4203	SAME AS P303			
P4204	SAME AS P101			
P4205	SAME AS P101			
P4501 AND P4502	SAME AS P101			
Q1 AND Q2	SEMICONDUCTOR DEVICE,TRANSISTOR	2N553	CK	13
Q101 THRU Q104	SEMICONDUCTOR DEVICE,TRANSISTOR	2N700	CK	5
Q105 THRU Q107	SEMICONDUCTOR DEVICE,TRANSISTOR,PNP TYPE /POLARAD PART NO. A702519	PADT-30	DN	7
Q201	SAME AS Q105			
Q301	SEMICONDUCTOR DEVICE,TRANSISTOR	2N499	CK	3
Q302	SEMICONDUCTOR DEVICE,TRANSISTOR	2N502	CK	2
Q303 AND Q304	SAME AS Q301			
Q305	SEMICONDUCTOR DEVICE,TRANSISTOR	2N1143	CK	2
Q306	SAME AS Q101			
Q401	SAME AS Q302			
Q402 AND Q403	SEMICONDUCTOR DEVICE,TRANSISTOR	2N384	CK	3
Q404	SAME AS Q305			
Q405	SEMICONDUCTOR DEVICE,TRANSISTOR	2N741	CK	1
Q501	SAME AS Q105			
Q502	SAME AS Q402			
Q503	SAME AS Q105			
Q504	SEMICONDUCTOR DEVICE,TRANSISTOR /POLARAD PART NO. B702611	113S2	FE	6
Q601	SEMICONDUCTOR DEVICE,TRANSISTOR	2N185	CK	2
Q602	SAME AS Q504			
Q603	SEMICONDUCTOR DEVICE,TRANSISTOR	2N234A	CK	1
Q604	SAME AS Q601			
Q605	SEMICONDUCTOR DEVICE,TRANSISTOR	2N427	CK	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
Q701	SEMICONDUCTOR DEVICE,TRANSISTOR /POLARAD PART NO. B704982	T1-494	CP	1
Q702	SAME AS Q504			
Q801	NOT USED			
Q802	SEMICONDUCTOR DEVICE,TRANSISTOR	2N1136	CK	12
Q803 THRU Q805	NOT USED			
Q806 THRU Q808	SAME AS Q802			
Q809	SEMICONDUCTOR DEVICE,TRANSISTOR	2N1008A	CK	2
Q810	NOT USED			
Q811	SAME AS Q504			
Q812 THRU Q814	SAME AS Q802			
Q815	NOT USED			
Q816 THRU Q819	SAME AS Q802			
Q820	NOT USED			
Q821	SAME AS Q802			
Q822	SAME AS Q809			
Q823 AND Q824	SAME AS Q504			
Q4201	SAME AS Q105			
R1	RESISTOR,COMPOSITION,5.6K,10 PCT,1/4W, USED ON SERIAL NOS. 1-1 THRU 1-25	RC07GF562K	AU	1
R1	RESISTOR,COMPOSITION,5.6K,10 PCT,1/2W, USED ON SERIAL NOS. 2-1 THRU 2-25	RC20GF562K	AU	1
R2	RESISTOR,VARIABLE,COMPOSITION,1K,10 PCT,1/2W /POLARAD PART NO. B704225/ USED ON SERIAL NOS. 1-1 THRU 1-25	GA1M032S102UC	D	1
R2	RESISTOR,VARIABLE,COMPOSITION,1K,20 PCT,1/2W, USED ON SERIAL NOS. 2-1 THRU 2-25	B707901	0E	1
R3	RESISTOR,COMPOSITION,470 OHMS,10 PCT,1/4W, USED ON SERIAL NOS. 1-1 THRU 1-25	RC07GF471K	AU	2
R3	RESISTOR,COMPOSITION,470 OHMS,10 PCT,1/2W, USED ON SERIAL NOS. 2-1 THRU 2-25	RC20GF471K	AU	1
R4	RESISTOR,VARIABLE,COMPOSITION,25K,10 PCT,1/2W /POLARAD PART NO. B704223/ USED ON SERIAL NOS. 1-1 THRU 1-25	GA1M032S253UC	U	1
R4	RESISTOR,VARIABLE,COMPOSITION,25K,20 PCT,1/2W /POLARAD PART NO. B116361/ USED ON SERIAL NOS. 2-1 THRU 2-25	X3536	UR	1
R5	RESISTOR,COMPOSITION,22K,10 PCT,1/2W, USED ON SERIAL NOS. 2-1 THRU 2-25	RC20GF223K	AU	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R6	RESISTOR,COMPOSITION,10K,10 PCT,1/2W, USED ON SERIAL NOS. 2-1 THRU 2-25	RC20GF103K	AU	1
R7	RESISTOR,COMPOSITION,4.7K,10 PCT,1/4W, USED ON SERIAL NOS. 1-1 THRU 1-25	RC07GF472K	AU	2
R7	RESISTOR,COMPOSITION,4.7K,10 PCT,1/2W, USED ON SERIAL NOS. 2-1 THRU 2-25	RC20GF472K	AU	1
R8	SAME AS R2,USED ON SERIAL NOS. 1-1 THRU 1-25			
R8	SAME AS R2,USED ON SERIAL NOS. 2-1 THRU 2-25			
R9	NOT USED			
R10	RESISTOR,COMPOSITION,2.2K,10 PCT,1/2W	RC20GF222K	AU	1
R11	RESISTOR,VARIABLE,COMPOSITION,50K,10 PCT,1/2W /POLARAD PART NO. B704228/ USED ON SERIAL NOS. 1-1 THRU 1-25	GA1M032S503UC	D	1
R11	SAME AS R4,USED ON SERIAL NOS. 2-1 THRU 2-25			
R12	SAME AS R4,USED ON SERIAL NOS. 1-1 THRU 1-25			
R12	RESISTOR,VARIABLE,COMPOSITION,10K,20 PCT,1/2W /POLARAD PART NO. B116360/ USED ON SERIAL NOS. 2-1 THRU 2-25	X3535	DR	1
R13	RESISTOR,VARIABLE,COMPOSITION,100K,10 PCT, 1/2W/POLARAD PART NO. B704227/ USED ON SERIAL NOS. 1-1 THRU 1-25	GA1M032S104UC	D	1
R13	RESISTOR,VARIABLE,COMPOSITION,100K,20 PCT, 1/2W/POLARAD PART NO. B131658/ USED ON SERIAL NOS. 2-1 THRU 2-25	X3538	DR	1
R14	RESISTOR,COMPOSITION,2.7K,10 PCT,1/4W	RC07GF272K	AU	1
R15	NOT USED			
R16	RESISTOR,COMPOSITION,2K,10 PCT,1/4W	RC07GF202K	AU	1
R17	RESISTOR,VARIABLE,COMPOSITION,2.5K,10 PCT,2W /POLARAD PART NO. 517845	RV4NAYSD252A	AU	1
R18	SAME AS R3,USED ON SERIAL NOS. 1-1 THRU 1-25			
R18	SAME AS R3,USED ON SERIAL NOS. 2-1 THRU 2-25			
R19	RESISTOR,COMPOSITION,1K,10 PCT,1/4W, USED ON SERIAL NOS. 1-1 THRU 1-25	RC07GF102K	AU	3
R19	RESISTOR,COMPOSITION,1K,10 PCT,1/2W, USED ON SERIAL NOS. 2-1 THRU 2-25	RC20GF102K	AU	1
R20	RESISTOR,COMPOSITION,68K,10 PCT,1/4W, USED ON SERIAL NOS. 1-1 THRU 1-25	RC07GF683K	AU	1
R20	RESISTOR,COMPOSITION,68K,10 PCT,1/2W, USED ON SERIAL NOS. 2-1 THRU 2-25	RC20GF683K	AU	1
R21	RESISTOR,VARIABLE,COMPOSITION, 500 OHMS,10 PCT,2W	RV4NAYSD501C	AU	1
R22	RESISTOR,COMPOSITION,18 OHMS,10 PCT,1/4W	RC07GF180K	AU	1
R23	RESISTOR,VARIABLE,COMPOSITION,10K,10 PCT,1W	RV4NAYSD103C	AU	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R24	RESISTOR,VARIABLE,COMPOSITION, 500 OHMS,10 PCT,1/2W	RV6NAYSB501A	AU	1
R25	NOT USED			
R26	RESISTOR,COMPOSITION,39 OHMS,10 PCT,2W	RC42GF390K	AU	1
R27 THRU R30	NOT USED			
R31	RESISTOR,COMPOSITION,68 OHMS,10 PCT,2W	RC42GF680K	AU	1
R32 AND R33	RESISTOR,COMPOSITION,15 OHMS,10 PCT,2W	RC42GF150K	AU	1
R34	SAME AS R31			
R101	RESISTOR,COMPOSITION,22K,10 PCT,1/4W	RC07GF223K	AU	2
R102	RESISTOR,COMPOSITION,1K,10 PCT,1/4W	RC07GF102K	AU	1
R103	RESISTOR,COMPOSITION,560 OHMS,10 PCT,1/4W	RC07GF561K	AU	2
R104	RESISTOR,COMPOSITION,100 OHMS,5 PCT,1/4W	RC07GF101J	AU	1
R105	SAME AS R101			
R106	SAME AS R102			
R107	SAME AS R103			
R108	SAME AS R102			
R109	SAME AS R101			
R110	SAME AS R102			
R111	SAME AS R103			
R112	NOT USED			
R113	SAME AS R14			
R114	RESISTOR,COMPOSITION,3.3K,10 PCT,1/4W	RC07GF332K	AU	1
R115	SAME AS R102			
R116	NOT USED			
R117	SAME AS R103			
R118	RESISTOR,COMPOSITION,5.6K,10 PCT,1/4W	RC07GF562K	AU	1
R119	RESISTOR,COMPOSITION,100 OHMS,10 PCT,1/4W	RC07GF101K	AU	1
R120	NOT USED			
R121	RESISTOR,COMPOSITION,56 OHMS,10 PCT,1/4W	RC07GF560K	AU	1
R122	SAME AS R103			
R123	RESISTOR,COMPOSITION,680 OHMS,10 PCT,1/4W	RC07GF681K	AU	2
R124	NOT USED			
R125	RESISTOR,COMPOSITION,2.2K,10 PCT,1/4W	RC07GF222K	AU	2
R126	SAME AS R114			
R127	SAME AS R102			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R128	NOT USED			
R129	SAME AS R103			
R130	RESISTOR•COMPOSITION•820 OHMS•10 PCT•1/4W	RC07GF821K	AU	1
R131	RESISTOR•COMPOSITION•1•2K•10 PCT•1/4W	RC07GF122K	AU	1
R132	RESISTOR•VARIABLE•COMPOSITION•100 OHMS• 10 PCT•1/2W/POLARAD PART NO• B704221	GA1M032S101UC	D	1
R133	SAME AS R114			
R134	SAME AS R102			
R135	SAME AS R103			
R136	NOT USED			
R137	SAME AS R123			
R138 AND R139	RESISTOR•COMPOSITION•270 OHMS•10 PCT•1/4W	RC07GF271K	AU	1
R140	SAME AS R22			
R201	RESISTOR•COMPOSITION•82 OHMS•5 PCT•1/2W	RC20GF820J	AU	1
R202	RESISTOR•COMPOSITION•7•5K•5 PCT•1W	RC32GF752J	AU	1
R203	SAME AS R201			
R204	SAME AS R202			
R205	NOT USED			
R206	RESISTOR•COMPOSITION•56 OHMS•10 PCT•1/4W	RC07GF560K	AU	1
R207	NOT USED			
R208	RESISTOR•COMPOSITION•2•2K•10 PCT•1/4W	RC07GF222K	AU	1
R209	RESISTOR•COMPOSITION•1K•10 PCT•1/4W	RC07GF102K	AU	1
R210	NOT USED			
R211	RESISTOR•COMPOSITION•5•6K•5 PCT•1/4W	RC07GF562J	AU	1
R212	SAME AS R209			
R213 AND R214	RESISTOR•COMPOSITION•330 OHMS•5 PCT•1/4W	RC07GF331J	AU	1
R215	NOT USED			
R216	RESISTOR•COMPOSITION•18 OHMS•5 PCT•1/2W	RC20GF180J	AU	1
R217	RESISTOR•COMPOSITION•33K•10 PCT•1/4W	RC07GF333K	AU	1
R218	RESISTOR•COMPOSITION•4•7K•10 PCT•1/4W	RC07GF472K	AU	1
R301	SAME AS R119			
R302 AND R303	NOT USED			
R304	RESISTOR•COMPOSITION•470 OHMS•10 PCT•1/4W	RC07GF471K	AU	1
R305	RESISTOR•COMPOSITION•4•7K•10 PCT•1/2W	RC20GF472K	AU	2

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R306	SAME AS R102			
R307	SAME AS R119			
R308	RESISTOR•COMPOSITION•330 OHMS•10 PCT•1/4W	RC07GF331K	AU	1
R309	SAME AS R305			
R310	SAME AS R102			
R311	NOT USED			
R312	SAME AS R308			
R313	NOT USED			
R314	SAME AS R131			
R315	SAME AS R102			
R316	SAME AS R308			
R317	SAME AS R102			
R318	RESISTOR•COMPOSITION•1•6K•10 PCT•1/4W	RC07GF162K	AU	1
R319	SAME AS R308			
R320	RESISTOR•COMPOSITION•3•9K•10 PCT•1/4W	RC07GF392K	AU	1
R321	RESISTOR•COMPOSITION•120 OHMS•10 PCT•1/4W	RC07GF121K	AU	1
R322	SAME AS R130			
R323	SAME AS R305			
R324 AND R325	NOT USED			
R326	SAME AS R125			
R401	RESISTOR•COMPOSITION•82 OHMS•10 PCT•1/4W	RC07GF820K	AU	1
R402	RESISTOR•COMPOSITION•6•8K•10 PCT•1/4W	RC07GF682K	AU	1
R403	SAME AS R125			
R404 AND R405	SAME AS R102			
R406	NOT USED			
R407	SAME AS R123			
R408	RESISTOR•COMPOSITION•1•8K•10 PCT•1/4W	RC07GF182K	AU	1
R409	RESISTOR•COMPOSITION•4•7K•10 PCT•1/4W	RC07GF472K	AU	1
R410	SAME AS R123			
R411	SAME AS R409			
R412	NOT USED			
R413	SAME AS R408			
R414	SAME AS R123			
R415	SAME AS R402			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R416	SAME AS R119			
R417	SAME AS R102			
R418	NOT USED			
R419	SAME AS R14			
R420	NOT USED			
R421	RESISTOR,COMPOSITION,3K,5 PCT,1/2W	RC20GF302J	AU	1
R422	SAME AS R10			
R423	RESISTOR,COMPOSITION,220 OHMS,10 PCT,1/2W	RC20GF221K	AU	1
R424	RESISTOR,COMPOSITION,150 OHMS,10 PCT,1/2W	RC20GF151K	AU	1
R425 THRU R428	NOT USED			
R429	RESISTOR,COMPOSITION,22 OHMS,10 PCT,1/4W	RC07GF220K	AU	1
R430	NOT USED			
R431	SAME AS R401			
R432	NOT USED			
R433	RESISTOR,COMPOSITION,10K,10 PCT,1/4W	RC07GF103K	AU	2
R434 AND R435	NOT USED			
R436	RESISTOR,COMPOSITION,150K,10 PCT,1/4W	RC07GF154K	AU	1
R437	NOT USED			
R438	SAME AS R101			
R439	SAME AS R433			
R440	NOT USED			
R441	SAME AS R304			
R501	RESISTOR,COMPOSITION,33 OHMS,5 PCT,1/4W	RC07GF330J	AU	1
R502	SAME AS R433			
R503	RESISTOR,COMPOSITION,3.6K,10 PCT,1/4W	RC07GF362K	AU	1
R504	SAME AS R102			
R505	RESISTOR,COMPOSITION,22 OHMS,5 PCT,1/4W	RC07GF220J	AU	1
R506	SAME AS R123			
R507	SAME AS R14			
R508	SAME AS R503			
R509	SAME AS R433			
R510	NOT USED			
R511	SAME AS R102			
R512	SAME AS R433			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R513	SAME AS R503			
R514	SAME AS R102			
R515	NOT USED			
R516	SAME AS R14			
R517 AND R518	SAME AS R409			
R519	RESISTOR•COMPOSITION•5•6K•5 PCT•1/4W	RC07GF562J	AU	1
R520	RESISTOR•COMPOSITION•2•7K•5 PCT•1/4W	RC07GF272J	AU	1
R521	NOT USED			
R522	RESISTOR•COMPOSITION•1•8K•5 PCT•1/4W	RC07GF182J	AU	1
R523	RESISTOR•COMPOSITION•12K•5 PCT•1/4W	RC07GF123J	AU	1
R524 AND R525	NOT USED			
R526 AND R527	RESISTOR•VARIABLE•COMPOSITION•5K•10 PCT•1/2W /POLARAD PART NO• B704222	GA1M032S502UC	D	1
R601	RESISTOR•COMPOSITION•18K•5 PCT•1/4W	RC07GF183J	AU	1
R602	RESISTOR•COMPOSITION•1K•5 PCT•1/4W	RC07GF102J	AU	1
R603	SAME AS R409			
R604	SAME AS R304			
R605 THRU R607	NOT USED			
R608	RESISTOR•COMPOSITION•1K•10 PCT•1/2W	RC20GF102K	AU	1
R609	SAME AS R320			
R610 AND R611	NOT USED			
R612	SAME AS R602			
R613	NOT USED			
R614	RESISTOR•COMPOSITION•62 OHMS•5 PCT•1/2W	RC20GF620J	AU	1
R615	SAME AS R433			
R616 AND R617	SAME AS R125			
R618	SAME AS R602			
R619	RESISTOR•COMPOSITION•220 OHMS•10 PCT•1/4W	RC07GF221K	AU	1
R620	NOT USED			
R621	RESISTOR•COMPOSITION•1•5K•10 PCT•1/4W	RC07GF152K	AU	1
R622	SAME AS R121			
R623	NOT USED			
R624	RESISTOR•COMPOSITION•8•2K•10 PCT•1/4W	RC07GF822K	AU	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R625 AND R626	NOT USED			
R627	SAME AS R409			
R628 AND R629	SAME AS R101			
R630	NOT USED			
R631	SAME AS R409			
R701	SAME AS R409			
R702	NOT USED			
R703	RESISTOR,COMPOSITION,6.2K,5 PCT,1/4W	RC07GF622J	AU	1
R704	RESISTOR,COMPOSITION,180 OHMS,10 PCT,1/4W	RC07GF181K	AU	1
R705	RESISTOR,COMPOSITION,10 MEGO,10 PCT,1/4W	RC07GF106K	AU	1
R706	SAME AS R703			
R707 THRU R709	NOT USED			
R710	SAME AS R101			
R711	NOT USED			
R712	SAME AS R433			
R713	RESISTOR,VARIABLE,COMPOSITION,10K,20 PCT,1/2W /POLARAD PART NO. B116360	X3535	DR	1
R714	RESISTOR,COMPOSITION,220 OHMS,10 PCT,1/4W	RC07GF221K	AU	1
R715	NOT USED			
R716	SAME AS R304			
R717	SAME AS R320			
R718	SAME AS R409			
R719	SAME AS R125			
R720	NOT USED			
R721	RESISTOR,VARIABLE,COMPOSITION,500 OHMS, 20 PCT,1/2W	B707902	BE	1
R722	SAME AS R125			
R723	SAME AS R304			
R724	SAME AS R308			
R725 THRU R731	NOT USED			
R732	RESIOTOR,COMPOSITION,4.7 MEGO,10 PCT,1/4W	RC07GF475K	AU	1
R733 AND R734	RESISTOR,COMPOSITION,22 MEGO,10 PCT,1/4W	RC07GF226K	AU	1
R735	NOT OSED			
R736	SAME AS R102			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R801 THRU R806	NOT USED			
R807 AND R808	RESISTOR•WW•0•3 OHMS•5 PCT•3W /POLARAD PART NO• B704316	RS-2B-•3J	EB	1
R809	RESISTOR•COMPOSITION•220 OHMS•10 PCT•2W	RC42GF221K	AU	1
R810	RESISTOR•COMPOSITION•100 OHMS•10 PCT•1/2W	RC20GF101K	AU	1
R811	RESISTOR•COMPOSITION•680 OHMS•10 PCT•1/2W	RC20GF681K	AU	1
R812	NOT USED			
R813	RESISTOR•COMPOSITION•3•3K•10 PCT•1/2W	RC20GF332K	AU	1
R814	RESISTOR•COMPOSITION•470 OHMS•10 PCT•1/2W	RC20GF471K	AU	1
R815	SAME AS R810			
R816 AND R817	RESISTOR•COMPOSITION•51 OHMS•5 PCT•1/2W	RC20GF510J	AU	1
R818 THRU R821	NOT USED			
R822	RESISTOR•VARIABLE•COMPOSITION•2K•10 PCT•1/4W /POLARAD PART NO• B704305	273-1-202	N	1
R823	RESISTOR•FILM•5K•1 PCT•1/4W /POLARAD PART NO• A704592	9855-2-5K-1	FX	1
R824	SAME AS R807			
R825	NOT USED			
R826 AND R827	SAME AS R807			
R828	RESISTOR•COMPOSITION•110 OHMS•5 PCT•2W	RC42GF111J	AU	1
R829 AND R830	NOT USED			
R831	SAME AS R814			
R832	SAME AS R813			
R833	SAME AS R809			
R834	SAME AS R811			
R835	NOT USED			
R836	RESISTOR•COMPOSITION•10 OHMS•10 PCT•2W	RC42GF100K	AU	1
R837 THRU R840	NOT USED			
R841	SAME AS R822			
R842	SAME AS R823			
R843	RESISTOR•COMPOSITION•680 OHMS•10 PCT•2W	RC42GF681K	AU	1
R844	RESISTOR•WW•600 OHMS•10 PCT•11W	RW29V601	AU	1
R845	NOT USED			
R846	RESISTOR•COMPOSITION•15 OHMS•10 PCT•2W	RC42GF150K	AU	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R847	SAME AS R813			
R848	SAME AS R836			
R849 THRU R851	NOT USED			
R852	RESISTOR,COMPOSITION,5.6K,10 PCT,1/2W	RC20GF562K	AU	1
R853	RESISTOR,COMPOSITION,15K,10 PCT,1/2W	RC20GF153K	AU	1
R854	RESISTOR,COMPOSITION,100 OHMS,10 PCT,2W	RC42GF101K	AU	1
R855	NOT USED			
R856	SAME AS R854			
R857	RESISTOR,WW,2 OHMS,5 PCT,7W /POLARAD PART NO. B706623	244E2R05	BN	1
R858	RESISTOR,COMPOSITION,150 OHMS,10 PCT,2W	RC42GF151K	AU	1
R859 AND R860	NOT USED			
R861	RESISTOR,WW,8.5K,10 PCT,3W /POLARAD PART NO. B704480	CS2-8.5K	EB	1
R4201 AND R4202	RESISTOR,VARIABLE,COMPOSITION,25K,20 PCT,1/2W /POLARAD PART NO. B116361	X3536	DR	1
R4203	RESISTOR,COMPOSITION,15 OHMS,10 PCT,1/4W	RC07GF150K	AU	1
R4204	RESISTOR,COMPOSITION,47 OHMS,10 PCT,1/4W	RC07GF470K	AU	1
R4205	NOT USED			
R4206	SAME AS R114			
R4207	SAME AS R433			
R4208	SAME AS R123			
R4209	SAME AS R102			
R4210	NOT USED			
R4211	RESISTOR,COMPOSITION,18 OHMS,5 PCT,1/4W	RC07GF180J	AU	1
R4212 AND R4213	RESISTOR,COMPOSITION,300 OHMS,5 PCT,1/4W	RC07GF301J	AU	1
R4214	RESISTOR,COMPOSITION,22 OHMS,10 PCT,1/2W	RC20GF220K	AU	1
R4215	NOT USED			
R4216	SAME AS R4214			
S1	SWITCH,TOGGLE,DPDT	MS25100-1	AV	1
S2	NOT USED			
S3	SWITCH,ROTARY,3 SECT,6 WAFERS,5 POSITIONS	B703319	BE	1
S4 THRU S6	SWITCH,TOGGLE,SPDT/POLARAD PART NO. B703121	8373K7	CD	1
S7	NOT USED			
S8 AND S9	SWITCH,SLIDE,DPDT/POLARAD PART NO. A701444	S-316-GY	EY	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
S701	SWITCH,ROTARY,2 SECT,2 WAFERS,4 POSITIONS	B703284	BE	1
S4201	SWITCH,ROTARY,5 SECT,9 WAFERS,3 POSITIONS	B703352	BE	1
TB1	TERMINAL BOARD,COMPONENT ASSY, USED ON SERIAL NOS. 1-1 THRU 1-25	C143013	BE	1
TB1	TERMINAL BOARD,COMPONENT ASSY, USED ON SERIAL NOS. 2-1 THRU 2-25	C147359	BE	1
TB2	TERMINAL BOARD/POLARAD PART NO. B700777	600-14	FD	1
TB3	TERMINAL BOARD/POLARAD PART NO. B704559	600-4	FD	1
TB701	TERMINAL BOARD,COMPONENT ASSY	C145309	BE	1
TB801	TERMINAL BOARD,COMPONENT ASSY	C145047	BE	1
TB802	TERMINAL BOARD,COMPONENT ASSY	C145043	BE	1
TB803	TERMINAL BOARD,COMPONENT ASSY	D146957	BE	1
TP1	TEST POINT,NON-REPLACEABLE PART OF C444			
TP101	TEST POINT/POLARAD PART NO. B701154	FT995DTUR		
T1	TRANSFORMER,POWER,STEP-DOWN /POLARAD PART NO. B707475	FT-11	BW	1
T101 THRU T104	TRANSFORMER,IF	B145060	BE	1
T105 AND T106	TRANSFORMER,IF	B145058	BE	1
T107	TRANSFORMER,IF	B145057	BE	1
T201	TRANSFORMER,RF,VARIABLE	B145234	BE	1
T202	NOT USED			
T203	TRANSFORMER,RF,VARIABLE	B145235	BE	1
T301	TRANSFORMER,RF,VARIABLE	B145238	BE	1
T302 THRU T306	NOT USED			
T307	TRANSFORMER,RF,VARIABLE	B145237	BE	1
T308	TRANSFORMER,RF,VARIABLE	B145246	BE	1
T401	TRANSFORMER,RF	B145231	BE	1
T402	TRANSFORMER,RF	B145230	BE	1
T501	TRANSFORMER,IF	B145059	BE	1
T502	TRANSFORMER,IF,VARIABLE,TWIN SECONDARY	B141177	BE	1
T601	TRANSFORMER,AF/POLARAD PART NO. B706501	TR-66	ER	1
T801	TRANSFORMER,POWER/POLARAD PART NO. B707447	ST26461	BQ	1
T802	TRANSFORMER,POWER/POLARAD PART NO. B706546	ST3730	BQ	1
T803	TRANSFORMER,POWER/POLARAD PART NO. B706544	ST3851	BQ	1
T804	TRANSFORMER,POWER/POLARAD PART NO. B707464	ST26401	BQ	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
T4201 AND T4202	NOT USED			
T4203	TRANSFORMER•RF	B145213	BE	1
V201 AND V202	ELECTRON TUBE/POLARAD PART NO• B702935	7077	HG	4
V401	ELECTRON TUBE	5639	CK	2
V701	ELECTRON TUBE	6021	CK	2
W1	CABLE ASSY•RF	C143019	BE	1
W2	CABLE ASSY•RF	C143020	BE	1
W3	CABLE ASSY•POWER	B701763	BE	1
W4	CABLE ASSY•RF	C143022	BE	1
W5	CABLE ASSY•RF	C143023	BE	1
W6	CABLE ASSY•RF	C143024	BE	1
W7	CABLE ASSY•RF	C143025	BE	1
W8	CABLE ASSY•RF	C143026	BE	1
W9	CABLE ASSY•RF	C143027	BE	1
W10	CABLE ASSY•RF•USED ON MODEL TR ONLY	C143028	BE	1
W11	CABLE ASSY•RF	C143029	BE	1
W12	CABLE ASSY•RF	C143030	BE	1
XDS1	LAMPHOLDER ASSY•ON/OPERATE /POLARAD PART NO• B705460	10-C3-2-RW-0-0-4-16	GU	1
XF1 THRU XF4	FUSEHOLDER•CARTRIDGE TYPE /POLARAD PART NO• 005626	341001	AP	1
XK801	NOT USED			
XK802	SOCKET•RELAY	TS103P01	AU	1
XQ1 AND XQ2	SOCKET•TRANSISTOR/POLARAD PART NO• A700898	14T24324	R	2
XQ101 THRU XQ107	SOCKET•TRANSISTOR/POLARAD PART NO• B701520	46T29017	R	3
XQ201	SAME AS XQ101			
XQ301 THRU XQ306	SAME AS XQ101			
XQ401 THRU XQ405	SAME AS XQ101			
XQ501 THRU XQ504	SAME AS XQ101			
XQ601 AND XQ602	SAME AS XQ101			
XQ603	SAME AS XQ1			
XQ604 AND XQ605	SAME AS XQ101			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
XQ801	NOT USED			
XQ802	SAME AS XQ1			
XQ803 THRU XQ805	NOT USED			
XQ806 AND XQ807	SAME AS XQ1			
XQ808	SAME AS XQ1			
XQ809	SAME AS XQ101			
XQ810	NOT USED			
XQ811	SAME AS XQ101			
XQ812 THRU XQ814	SAME AS XQ1			
XQ815	NOT USED			
XQ816 THRU XQ819	SAME AS XQ1			
XQ820	NOT USED			
XQ821	SAME AS XQ1			
XQ822 AND XQ823	SAME AS XQ101			
XQ824	SAME AS XQ101			
XQ4201	SAME AS XQ101			
XV201	SOCKET,ELECTRON TUBE	B138768	BE	1
XV202	SOCKET,ELECTRON TUBE	B138764	BE	1
XV401	SOCKET,ELECTRON TUBE/POLARAD PART NO. B703865	132-28-92-022	R	1
XV701	SOCKET,ELECTRON TUBE/POLARAD PART NO. B707999	132-18-12-016	R	1
Y301	CRYSTAL,QUARTZ,60MC,0.002 PCT /POLARAD PART NO. A706373	4202-60	ES	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
	SUPPLIED ACCESSORIES			
A1100	ACCESSORY KIT	A146321	BE	1
A1101	WRENCH KIT	A25109	BE	1
CP1100	CONNECTOR,ADAPTER,3 TO 2 PINS,BLACK /POLARAD PART NO. A131966	228-BLK	FS	1
J1206	CONNECTOR,PLUG,FEMALE,40 PINS,WITH HOOD DPX-20745/POLARAD PART NO. B703159	DPX-J40C1-33S	CF	1
MP1100	WRENCH,KLYSTRON	B144477	BE	1
MP1101	WRENCH,KLYSTRON	B144525	BE	1
MP1104	WRENCH,SPANNER	A15550	BE	1
MP1105	WRENCH,SPLINE	515101	BE	1
MP1106	WRENCH,SPLINE	515102	BE	1
MP1107	WRENCH,SPLINE	515103	BE	1
MP1108	WRENCH,SPLINE	515104	BE	1
MP1109	WRENCH,ALLEN	515301	BE	1
MP1110	WRENCH,ALLEN	515302	BE	1
MP1111	WRENCH,ALLEN	515303	BE	1
MP1112	WRENCH,ALLEN	515304	BE	1
P1 AND P2	CONNECTOR,PLUG,MALE,TNC TYPE /POLARAD PART NO. B707496	100-T1000	EA	1
P3 AND P4	CONNECTOR,PLUG,MALE,BNC TYPE	UG-88/U	AU	1
P7 AND P8	CONNECTOR,PLUG,MALE,N TYPE	UG-21D/U	AU	1
P1106	CONNECTOR,PLUG,MALE,40 PINS,WITH HOOD DPX-20745/POLARAD PART NO. B703158	DPX-J40C1-34P	CF	1
W13	CABLE ASSY,RF	C143031	BE	1
W31	CABLE ASSY,RF	B12551	BE	1
W32	CABLE ASSY,VIDEO	B12553	BE	1
W35	CABLE ASSY,POWER	C146172	BE	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
	T-RL TUNING UNIT			
A1201	OSCILLATOR ASSY	C20566	BE	1
A1202	CABLE AND MIXER ASSY,NON-REPLACEABLE PART OF Z1201			
CR1201	SEMICONDUCTOR DEVICE,DIODE,CRYSTAL,SILICON	1N21D	CK	5
CR1202	SEMICONDUCTOR DEVICE,DIODE /POLARAD PART NO. B703676	XS-23A	GC	5
FL1201	FILTER ASSY,LOW-PASS	A27611	BE	1
FL1202	FILTER ASSY,LOW-PASS	A146678	BE	1
H1201	KNOB/POLARAD PART NO. 507301	125-6-2	BH	1
J1201	CONNECTOR,RECEPTACLE,FEMALE,N TYPE	UG-556/U	AU	1
J1202	CONNECTOR,RECEPTACLE,FEMALE	B21484-1	BE	1
J1203 AND J1204	CONNECTOR,RECEPTACLE,FEMALE,N TYPE, NON-REPLACEABLE PART OF FL1202			
J1205	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE /POLARAD PART NO. A700378	1560	GL	1
J1207 AND J1208	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE	UG-625A/U	AU	1
MP1201	KLYSTRON COVER AND SOCKET ASSY	BK50146	BE	1
P1201	NOT USED			
P1202 AND P1203	CONNECTOR,PLUG,MALE,N TYPE	UG-536A/U	AU	1
P1204	CONNECTOR,PLUG,MALE,N TYPE, USED ON SERIAL NOS. 1-1 THRU 1-10	RF-0364A	EA	1
P1204	CONNECTOR,PLUG,MALE,N TYPE, USED ON SERIAL NOS. 2-1 THRU 2-10	UG-536A/U	AU	1
P1205	CONNECTOR,PLUG,MALE,BNC TYPE	UG-88C/U	AU	1
P1206	CONNECTOR,PLUG,MALE,40 PINS /POLARAD PART NO. B703158	DPX-J40C1-34P	CF	1
P1207 AND P1208	SAME AS P1205			
R1201	RESISTOR,VARIABLE,COMPOSITION,2.5K,10 PCT,2W /POLARAD PART NO. 517845	RV4NAYSD252A	AU	1
R1202	RESISTOR,COMPOSITION,15K,10 PCT,1/2W	RC20GF153K	AU	1
R1203	RESISTOR,COMPOSITION,100K,10 PCT,1/2W	RC20GF104K	AU	1
R1204	RESISTOR,VARIABLE,COMPOSITION,50K,10 PCT,2W /POLARAD PART NO. 517853	RV4NAYSD503A	AU	1
R1205	RESISTOR,VARIABLE,WW,100K,5 PCT,9W	B114392	BE	1
R1206	RESISTOR,COMPOSITION,150K,10 PCT,2W	RC42GF154K	AU	1
R1207	RESISTOR,VARIABLE,COMPOSITION,100K,10 PCT,2W /POLARAD PART NO. 517923	RV4NAYSD104A	AU	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R1208 THRU R1210	NOT USED			
R1211	RESISTOR,COMPOSITION,18K,5 PCT,1/2W	RC20GF183J	AU	1
R1212	RESISTOR,VARIABLE,COMPOSITION,1.5K,10 PCT,2W /POLARAD PART NO. 517844	RV4NAYSD152A	AU	1
R1213	SAME AS R1211			
R1214 THRU R1226	NOT USED			
R1227	RESISTOR,FILM,325K,1 PCT,1W /POLARAD PART NO. A705441	9850-2-325K	FX	1
R1228	RESISTOR,FILM,925K,1 PCT,2W /POLARAD PART NO. A705429	9849-2-925K	FX	1
R1229	NOT USED			
R1230	RESISTOR,COMPOSITION,39 OHMS,10 PCT,1/2W	RC20GF390K	AU	1
TB1201	TERMINAL BOARD,COMPONENT ASSY	C141807	BE	1
TB1202	NOT USED			
TB1203	TERMINAL BOARD/POLARAD PART NO. B704565	600-10	FD	1
TB1204 AND TB1205	NOT USED			
TB1206	TERMINAL BOARD,COMPONENT ASSY	B146672	BE	1
TP1201	JACK,TEST POINT,BLACK /POLARAD PART NO. B700820	105-203-200	EZ	1
TP1202	JACK,TEST POINT,RED/POLARAD PART NO. B700819	105-202-200	EZ	1
V1201	ELECTRON TUBE,KLYSTRON	ZV1010/7505	BE	1
W81	CABLE ASSY,RF	B143376	BE	1
W82	CABLE ASSY,RF	B143375	BE	1
W83	CABLE AND PROBE ASSY,NON-REPLACEABLE PART OF A1202			
W84	CABLE ASSY,RF	B143374	BE	1
W85	NOT USED			
W86	CABLE ASSY,RF	B146788	BE	1
Z1201	PRESELECTOR ASSY	C141982	BE	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
	T-RM TUNING UNIT			
A1401	OSCILLATOR,RF	D141342	BE	1
A1402	TRACKING DEVICE ASSY	C141965	BE	1
A1403	MIXER ASSY,NON-REPLACEABLE PART OF Z1401			
CP1400	CONNECTOR,ADAPTER,TEE,BNC TYPE	UG-274B/U	AU	1
CR1401	SEMICONDUCTOR DEVICE,DIODE,CRYSTAL,SILICON	1N23D	CK	5
CR1402	SEMICONDUCTOR DEVICE,DIODE /POLARAD PART NO. 5703676	XS-23A	GC	5
C1401 AND C1402	NOT USED			
C1403	CAPACITOR,MICA,1000UUF,10 PCT,500WVDC, NON-REPLACEABLE PART OF Z1400			
H1401	KNOB/POLARAD PART NO. 507301	125-6-2	BH	1
J1401	CONNECTOR,RECEPTACLE,FEMALE,N TYPE	UG-160C/U	AU	1
J1402	CONNECTOR,PLATE,NON-REPLACEABLE PART OF Z1401			
J1403	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE /POLARAD PART NO. A700378	1560	GL	1
J1404	NOT USED			
J1405	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE, NON-REPLACEABLE PART OF CP1400			
J1406	NOT USED			
J1407	SAME AS J1405			
MP1401	KLYSTRON COVER AND SOCKET ASSY	BK50146	BE	1
P1401	NOT USED			
P1402	CONNECTOR,HOUSING AND COUPLING ASSY, NON-REPLACEABLE PART OF W71			
P1403	CONNECTOR,PLUG,MALE,BNC TYPE, NON-REPLACEABLE PART OF CP1400			
P1404	NOT USED			
P1405	CONNECTOR,PLUG,MALE,BNC TYPE	UG-88/U	AU	1
P1406	CONNECTOR,PLUG,MALE,40 PINS /POLARAD PART NO. 5703158	DPX-J40C1-34P	CF	1
P1407	CONNECTOR,PLUG,MALE,BNC TYPE,RT ANGLE	UG-913/U	AU	1
R1401	RESISTOR,VARIABLE,COMPOSITION,2.5K,10 PCT,2W /POLARAD PART NO. 517845	RV4NAYSD252A	AU	1
R1402	RESISTOR,COMPOSITION,100K,10 PCT,1/2W	RC20GF104K	AU	1
R1403	RESISTOR,FILM,MICROWAVE,50 OHMS,10 PCT,1/2W /POLARAD PART NO. A544106/ NON-REPLACEABLE PART OF W73			
R1404	RESISTOR,VARIABLE,COMPOSITION,150K,10 PCT,2W /POLARAD PART NO. 517924	RV4NAYSD154A	AU	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R1405	RESISTOR•VARIABLE•WW•100K•5 PCT•9W	B114392	BE	1
R1406 AND R1407	SAME AS R1404			
R1408	NOT USED			
R1409	SAME AS R1404			
R1410	NOT USED			
R1411	RESISTOR•COMPOSITION•18K•5 PCT•1/2W	RC20GF183J	AU	1
R1412	RESISTOR•VARIABLE•COMPOSITION•1•5K•10 PCT•2W /POLARAD PART NO• 517844	RV4NAYSD152A	AU	1
R1413	SAME AS R1411			
R1414 THRU R1425	NOT USED			
R1426 AND R1427	RESISTOR•FILM•625K•1 PCT•1W /POLARAD PART NO• A705442	9850-2-625K	FX	1
R1428 AND R1429	RESISTOR•FILM•925K•1 PCT•2W /POLARAD PART NO• A705429	9849-2-925K	FX	1
R1430	RESISTOR•COMPOSITION•39 OHMS•10 PCT•1/2W	RC20GF390K	AU	1
S1401	SWITCH•SENSITIVE•SPDT/POLARAD PART NO• A20436	V3-13	AX	1
TB1401	TERMINAL BOARD•COMPONENT ASSY	B146670	BE	1
TB1402	TERMINAL BOARD•COMPONENT ASSY	B141559	BE	1
TB1403	TERMINAL BOARD/POLARAD PART NO• B704565	600-10	FD	1
TP1401	JACK•TEST POINT•BLACK /POLARAD PART NO• B700820	105-203-200	EZ	1
TP1402	JACK•TEST POINT•RED/POLARAD PART NO• B700819	105-202-200	EZ	1
V1401	ELECTRON TUBE•KLYSTRON	ZV1011/8052	BE	1
W71	CABLE ASSY•RF	B142602	BE	1
W72	NOT USED			
W73	CABLE AND PROBE ASSY	B138257	BE	1
W74	CABLE ASSY•RF	B143373	BE	1
Z1400	CONTROL•FREQUENCY SELECTOR	A137622	BE	1
Z1401	PRESELECTOR ASSY	C141543	BE	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
	T-RS TUNING UNIT			
A1301	OSCILLATOR ASSY	C21672	0E	.1
A1302	MIXER ASSY•NON-REPLACEABLE PART OF Z1301			
CP1300	CONNECTOR•ADAPTER•TEE•BNC TYPE	UG-274A/U	AU	1
CP1301	CONNECTOR•ADAPTER•FEMALE•BNC TYPE	UG-914/U	AU	1
CR1301	SEMICONDUCTOR DEVICE•DIODE•CRYSTAL•SILICON	1N21D	CK	5
CR1302	SEMICONDUCTOR DEVICE•DIODE /POLARAD PART NO• B703676	XS-23A	0C	5
C1301	CAPACITOR•MICA•1000UUF•10 PCT•500WVDC• NON-REPLACEABLE PART OF Z1300			
FL1301	FILTER ASSY•LOW-PASS	A146679	0E	1
H1301	KNOB/POLARAD PART NO• 507301	125-6-2	0H	1
J1301	CONNECTOR•RECEPTACLE•FEMALE•N TYPE	UG-556/U	AU	1
J1302	CONNECTOR•RECEPTACLE•FEMALE•BNC TYPE• NON-REPLACEABLE PART OF Z1301			
J1303 AND J1304	CONNECTOR•RECEPTACLE•FEMALE•N TYPE• NON-REPLACEABLE PART OF FL1301			
J1305	CONNECTOR•RECEPTACLE•FEMALE•BNC TYPE NON-REPLACEABLE PART OF CP1300			
J1306	NOT USED			
J1307	CONNECTOR•RECEPTACLE•FEMALE•BNC TYPE• NON-REPLACEABLE PART OF CP1301			
J1308	SAME AS J1305			
J1309	SAME AS J1307			
MP1301	KLYSTRON COVER AND SOCKET ASSY	BK50146	0E	1
P1301	NOT USED			
P1302	CONNECTOR•PLUG•MALE•BNC TYPE•RT ANGLE	UG-913/U	AU	1
P1303	CONNECTOR•PLUG•MALE•N TYPE	UG-536A/U	AU	1
P1304	CONNECTOR•PLUG•MALE•N TYPE• USED ON SERIAL NOS• 1-1 THRU 1-20	RF-0304A	EA	1
P1304	CONNECTOR•PLUG•MALE•N TYPE• USED ON SERIAL NOS• 2-1 THRU 2-15	UG-536A/U	AU	1
P1305	CONNECTOR•PLUG•MALE•BNC TYPE	UG-88/U	AU	1
P1306	CONNECTOR•PLUG•MALE•40 PINS /POLARAD PART NO• B703158	DPX-J40C1-34P	0F	1
P1307	CONNECTOR•PLUG•MALE•BNC TYPE	UG-88/U	AU	1
P1308	SAME AS P1305			
P1309	CONNECTOR•PLUG•MALE•BNC TYPE• NON-REPLACEABLE PART OF CP1300			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R1301	RESISTOR•VARIABLE•COMPOSITION•2•5K•10 PCT•2W /POLARAD PART NO• 517845	RV4NAYSD252A	AU	1
R1302	RESISTOR•COMPOSITION•15K•10 PCT•1/2W	RC20GF153K	AU	1
R1303	RESISTOR•COMPOSITION•100K•10 PCT•1/2W	RC20GF104K	AU	1
R1304	RESISTOR•VARIABLE•COMPOSITION•50K•10 PCT•2W /POLARAD PART NO• 517853	RV4NAYSD503A	AU	1
R1305	RESISTOR•VARIABLE•WW•100K•5 PCT•9W	B114392	BE	1
R1306	RESISTOR•COMPOSITION•47K•10 PCT•2W	RC42GF473K	AU	1
R1307	RESISTOR•VARIABLE•COMPOSITION•100K•10 PCT•2W /POLARAD PART NO• 517923	RV4NAYSD104A	AU	1
R1308	RESISTOR•FILM•MICROWAVE•50 OHMS•10 PCT•1/2W /POLARAD PART NO• A544106/ NON-REPLACEABLE PART OF W63			
R1309 AND R1310	NOT USED			
R1311	RESISTOR•COMPOSITION•18K•5 PCT•1/2W	RC20GF183J	AU	1
R1312	RESISTOR•VARIABLE•COMPOSITION•1•5K•10 PCT•2W /POLARAD PART NO• 517844	RV4NAYSD152A	AU	1
R1313	SAME AS R1311			
R1314 THRU R1326	NOT OSED			
R1327	RESISTOR•FILM•325K•1 PCT•1W /POLARAD PART NO• A705441	9850-2-325K	FX	1
R1328	RESISTOR•FILM•925K•1 PCT•2W /POLARAD PART NO• A705429	9849-2-925K	FX	1
R1329	NOT USED			
R1330	RESISTOR•COMPOSITION•39 OHMS•10 PCT•1/2W	RC20GF390K	AU	1
TB1301	TERM&NAL BOARD•COMPONENT ASSY	C141313	BE	1
TB1302	NOT USED			
TB1303	TERMINAL BOARD/POLARAD PART NO• B704565	600-10	FD	1
TB1304 AND TB1305	NOT USED			
TB1306	TERMINAL BOARD•COMPONENT ASSY	B146671	BE	1
TP1301	JACK•TEST POINT•BLACK /POLARAD PART NO• B700820	105-203-200	EZ	1
TP1302	JACK•TEST POINT•RED/POLARAD PART NO• B700819	105-202-200	EZ	1
V1301	ELECTRON TUBE•KLYSTRON	ZV1009/7049	BE	1
W61	CABLE ASSY•RF	B143553	BE	1
W62	CABLE AND MIXER ASSY	A132260	BE	1
W63	CABLE AND PROBE ASSY	B141348	BE	1
W64	CABLE ASSY•RF	B143552	BE	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
W65	NOT USED			
W66	CABLE ASSY,RF	B146972	BE	1
Z1300	CONTROL,FREQUENCY SELECTOR	A130042	BE	1
Z1301	PRESELECTOR ASSY	D141084	BE	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
	T-RX TUNING UNIT			
A1501	OSCILLATOR ASSY,RF	D145282	BE	1
A1502	TRACKING DEVICE ASSY	C141962	BE	1
A1503	MIXER ASSY,NON-REPLACEABLE PART OF Z1501			
CR1501	SEMICONDUCTOR DEVICE,DIODE,CRYSTAL	1N2510	CK	5
CR1502	SEMICONDUCTOR DEVICE,DIODE /POLARAD PART NO. B703676	XS-23A	GC	5
CP1500	CONNECTOR,ADAPTER,TEE,BNC TYPE	UG-274/U	AU	1
CP1501	CONNECTOR,ADAPTER,MALE,BNC TYPE	UG-491A/U	AU	1
C1501	CAPACITOR,MICA,1000UUF,10 PCT,500WVDC, NON-REPLACEABLE PART OF Z1500			
H1501	KNOB/POLARAD PART NO. 507301	125-6-2	BH	1
J1501	CONNECTOR,RECEPTACLE,FEMALE,N TYPE	UG-160C/U	AU	1
J1502	CONNECTOR,INPUT,FEMALE,1 PIN, NON-REPLACEABLE PART OF Z1501			
J1503	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE,RT ANGLE	B137627	BE	1
J1504 AND J1505	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE, NON-REPLACEABLE PART OF CP1500			
J1506	NOT USED			
J1507	CONNECTOR,RECEPTACLE,MALE,BNC TYPE, NON-REPLACEABLE PART OF CP1500			
MP1501	KLYSTRON COVER AND SOCKET ASSY	BK50148	BE	1
P1501	NOT USED			
P1502	CONNECTOR,PLUG,MALE,N TYPE	UG-21B/U	AU	1
P1503 AND P1504	CONNECTOR,PLUG,MALE,BNC TYPE, NON-REPLACEABLE PART OF CP1501			
P1505	CONNECTOR,PLUG,MALE,BNC TYPE	UG-88/U	AU	1
P1506	CONNECTOR,PLUG,MALE,40 PINS /POLARAD PART NO. B703158	DPX-J40C1-34P	CF	1
P1507	CONNECTOR,PLUG,FEMALE,BNC TYPE	UG-89/U	AU	1
R1501	RESISTOR,VARIABLE,COMPOSITION,2.5K,10 PCT,2W /POLARAD PART NO. 517845	RV4NAYSD252A	AU	1
R1502	RESISTOR,COMPOSITION,100K,10 PCT,1/2W	RC20GF104K	AU	1
R1503	RESISTOR,FILM,MICROWAVE,50 OHMS,10 PCT,1/2W /POLARAD PART NO. A544106/ NON-REPLACEABLE PART OF W53			
R1504	RESISTOR,VARIABLE,COMPOSITION,250K,10 PCT,2W /POLARAD PART NO. 517925	RV4NAYSD254A	AU	1
R1505	RESISTOR,VARIABLE,WW,100K,5 PCT,9W	B114392	BE	1
R1506 AND R1507	SAME AS R1504			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R1508	NOT USED			
R1509	SAME AS R1504			
R1510	NOT USED			
R1511	RESISTOR•COMPOSITION•4•7K•5 PCT•1/2W	RC20GF472J	AU	1
R1512	RESISTOR•VARIABLE•COMPOSITION•1•5K•10 PCT•2W /POLARAD PART NO• 517844	RV4NAYSD152A	AU	1
R1513	RESISTOR•COMPOSITION•27K•5 PCT•1/2W	RC20GF273J	AU	1
R1514 THRU R1525	NOT USED			
R1526 AND R1527	RESISTOR•FILM•625K•1 PCT•1W /POLARAD PART NO• A705442	9850-2-625K	FX	1
R1528 AND R1529	RESISTOR•FILM•925K•1 PCT•2W /POLARAD PART NO• A705429	9849-2-925K	FX	1
R1530	RESISTOR•COMPOSITION•39 OHMS•10 PCT•1/2W	RC20GF390K	AU	1
S1501	SWITCH•SENSITIVE•SPDT/POLARAD PART NO• A20438	V3-13	AX	1
TB1501	TERMINAL BOARD•COMPONENT ASSY	B146669	BE	1
TB1502	TERMINAL BOARD•COMPONENT ASSY	B141560	BE	1
TB1503	TERMINAL BOARD/POLARAD PART NO• B704565	600-10	FD	1
TP1501	JACK•TEST POINT•BLACK /POLARAD PART NO• B700820	105-203-200	EZ	1
TP1502	JACK•TEST POINT•RED/POLARAD PART NO• B700819	105-202-200	EZ	1
V1501	ELECTRON TUBE•KLYSTRON	ZV1011/8052	BE	1
W51	CABLE ASSY•RF	B143536	BE	1
W52	NOT USED			
W53	CABLE AND PROBE ASSY	B138257	BE	1
W54	CABLE ASSY•RF	B143888	BE	1
Z1500	CONTROL•FREQUENCY SELECTOR	A137622	BE	1
Z1501	PRESELECTOR ASSY	C141547	BE	1

POLARAD

POLARAD ELECTRONIC INSTRUMENTS

A DIVISION OF POLARAD ELECTRONICS CORPORATION

34-02 QUEENS BOULEVARD · LONG ISLAND CITY 1, N.Y. · AREA CODE 212 · EXETER 2-4500

REQUEST FOR MAINTENANCE

FROM:

COMPANY NAME _____ DATE: _____

ADDRESS: _____ INDIVIDUAL _____

_____ POSITION _____

SECTION OR DIVISION _____ PHONE NO. _____ EXT. _____

EQUIPMENT _____ DATE OF PURCHASE _____

MODEL _____ SERIAL NO. _____ ORDER NO. _____

TROUBLE REPORT:

A. Description of trouble _____

B. Has trouble been localized? _____ If so, how and where: _____

C. Instruments used and measurements taken, if any: _____

_____

_____

_____

D. Is trouble intermittent? _____

E. Hours of operation prior to this trouble _____

F. Date trouble occurred _____

G. Was factory consulted by telephone or letter prior to this request? _____

If so, give date and person to whom directed: _____

_____

H. Additional Comments: _____

_____

_____

_____

_____

_____

_____

When trouble develops requiring factory assistance, complete this form and send to:

Polarad Electronic Instruments
Division of
Polarad Electronics Corporation
34-02 Queens Boulevard
Long Island City 1, New York
ATTENTION: Service Department

After this report has been analyzed by the Service Department, you will be notified when a field service engineer will call on you to make the necessary repairs. If your trouble can best be corrected at the factory, we will so notify you with instructions and authorization for returning the equipment.

NO EQUIPMENT MAY BE RETURNED TO THE FACTORY WITHOUT WRITTEN AUTHORIZATION

POLARAD

WORLD LEADER IN MICROWAVE INSTRUMENTATION